UNI
8126

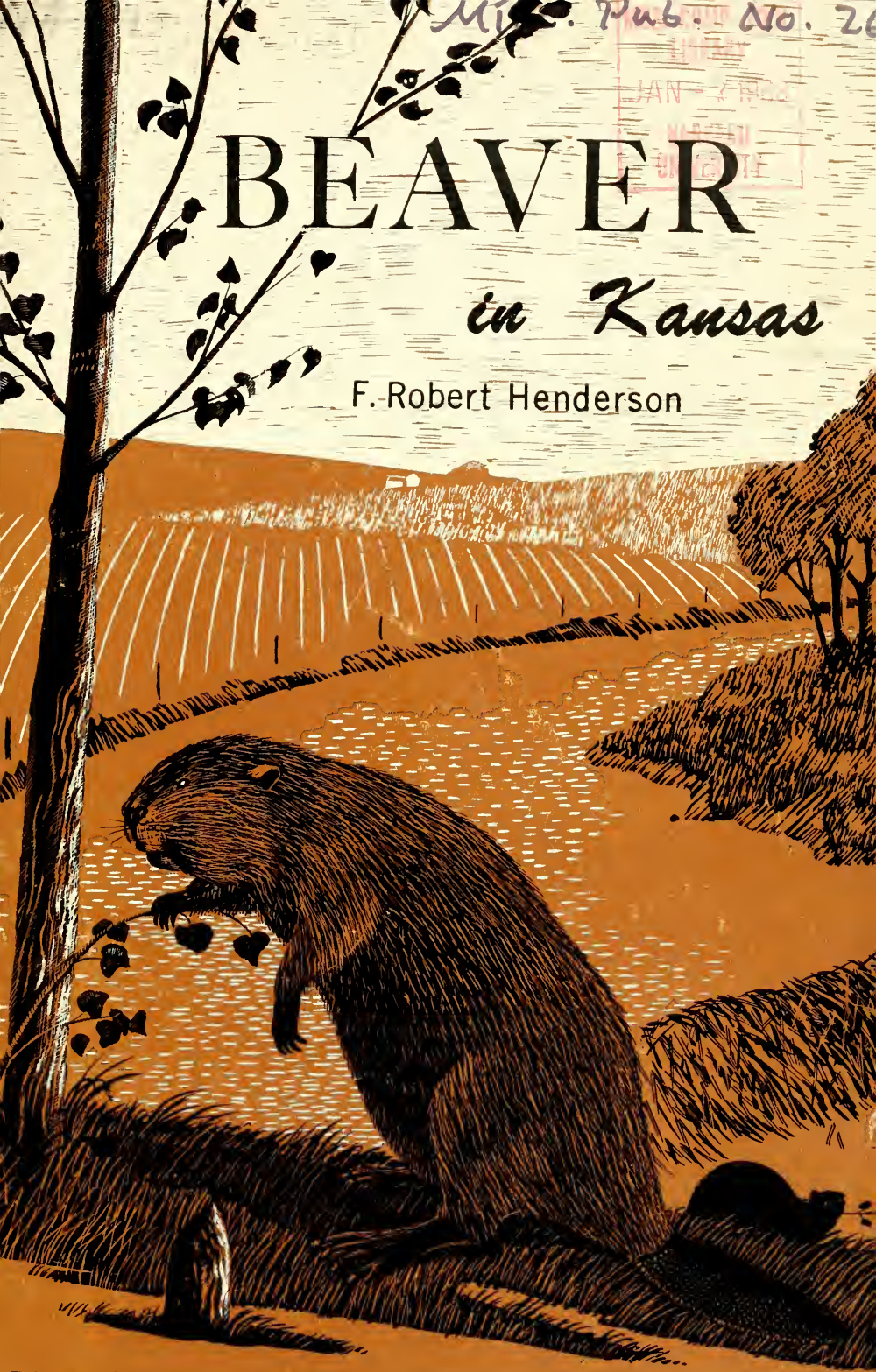
HARVARD UNIVERSITY

Library of the
Museum of
Comparative Zoology

Misc. Pub. No. 26
JAN - 2 1953

BEAVER *in Kansas*

F. Robert Henderson



Biological Survey and The University of Kansas
Museum of Natural History

Beaver in Kansas

BY

F. Robert Henderson

State Biological Survey and Museum of Natural History
University of Kansas

UNIVERSITY OF KANSAS

MUSEUM OF NATURAL HISTORY

EDITOR: E. RAYMOND HALL

Miscellaneous Publication No. 26, pp. 1-85, figures 1-36
Published December 16, 1960

MUS. COMP. ZOOL
LIBRARY
JAN - 7 1963
HARVARD
UNIVERSITY

PRINTED IN
THE STATE PRINTING PLANT
TOPEKA, KANSAS
1960

28-4990

CONTENTS

	PAGE
INTRODUCTION	5
ACKNOWLEDGMENTS	8
SUBSPECIES	8
DISTRIBUTION AND NUMBERS	9
HISTORY	17
ECONOMIC IMPORTANCE	25
MANAGEMENT	31
ECOLOGY	34
Habitat Requirements	34
Colony Organization and Behavior	36
Mortality Factors	51
TRAPPING AND PELTING	51
Knowledge of Habits—Traps and Equipment	51
Trapping	53
Pelting	58
Stretching	60
RECIPES	63
CONCLUSIONS AND RECOMMENDATIONS	64
LITERATURE CITED	83

INTRODUCTION

Many people are surprised when they learn that beaver live in Kansas, for, in the minds of most people, beaver are associated with the mountains. Nevertheless much of the early exploration of Kansas was done by traders and trappers in the course of their search for beaver. The intensive and continued trapping soon greatly decreased the population of beaver, and the animal for a time was threatened with extinction. Protection, natural dispersal, and transplantation account for re-establishment of the beaver in parts of Kansas where it was killed out.

FIG. 1. This typical Kansas Beaver (*Castor canadensis missouriensis*) was captured on January 9, 1960, on Mud Creek approximately 1 mile north of Midland in Douglas County, Kansas. This adult female weighed 52 pounds. $\times \frac{1}{7}$. Photo by George Latham.

The beaver (Fig. 1) is the largest of the several hundred kinds of rodents in the United States. Among mammals the beaver is second only to man in altering the natural environment to suit the needs of the species. The tools of the beaver include its four, bright, orange, incisor teeth that grow continually throughout the life of the beaver. The back side of the incisors wears away and the harder front surface remains; this forms a beveled edge that is kept sharpened through continued use (Fig. 2). These opposed

pairs of chisels are used effectively by the beaver in cutting saplings and in felling even large trees and then are used in removing the outer dead bark and in stripping off and cutting loose the inner growing layer of bark that constitutes the principal food of beaver. The beaver pushes, pulls, digs and grapples by means of its fore-

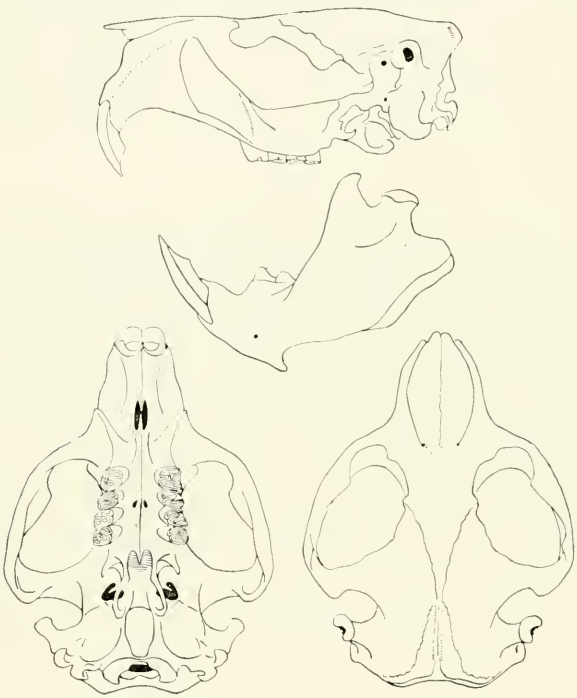


Fig. 2. Skull and left lower jaw of Beaver (*Castor canadensis missouriensis*), 2½ miles east, 1 mile south of Osawatomie, Miami County, Kansas, adult female, No. 81772 KU, × ⅓. Note beveled edge of incisor teeth that are kept sharp through continued use.

paws. The distinctive flat scaly tail is used as a prop while sitting, for warning by slapping the surface of the water when the beaver dives in alarm, and as a rudder when the animal swims. The beaver is an aquatic animal. The webbed hind feet are used to propel the animal through the water. A peculiar double toenail found on the second toe of each hind foot (Fig. 3) is used to comb and distribute oil on the fur. The lips close behind the incisors to exclude water from the mouth while the beaver works underwater. The valvular ears and nostrils are closed when the beaver is submerged. The color of the fur is dark brown but in beaver in Kan-

sas ranges from light brown to black, being slightly paler on the underside than on the back and sides. Most adults weigh between 30 and 50 pounds, but larger individuals are often reported taken in Kansas. A 97-pound beaver was found dead on Salt Creek, in Cloud County, Kansas, by H. D. Byrne, District Game Protector, in the fall of 1951 (Byrne, 1954, *in litt.*). There is no external difference between the sexes, except that the two pairs of mammae (teats) are visible in females during late pregnancy and when the young are nursing. Beaver are nocturnal and seldom work in daylight. They are peaceful animals and even when trapped or cornered rarely show fight.

Few other animals engender greater popular or aesthetic interest in the public mind than do beaver. The relationship of beaver to the land and to other wildlife is of great significance. This signifi-

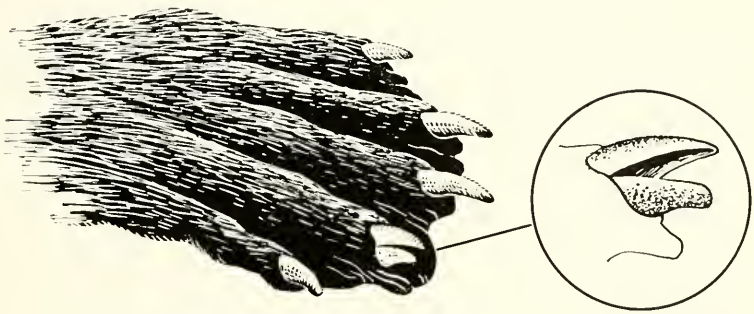


FIG. 3. Combing claw on second digit of left hind foot of beaver approximately 1½ years old. Buck Creek, Jefferson County, Kansas. Foot × ½.

cance plus the monetary return from beaver pelts puts the beaver high on the list of wildlife resources in Kansas. The preparation of this bulletin was undertaken with the aim of creating a better understanding of the beaver's role in the modern fauna of Kansas, and to create sentiment favoring its conservation. Four objectives were settled upon as follows:

(1) Assembling a record of the history of beaver in Kausas.
(2) Indicating the economic status of beaver in Kansas.
(3) Making a contribution to knowledge of the ecology of the Kansas beaver.
(4) Recording proven methods of trapping and pelting beaver.

In June, 1959, intensive study was begun to organize material for this bulletin. No other study dealing exclusively with beaver has been made in Kansas, and many of the statements beyond are based on conclusions of workers who studied beaver in other

states. Some information was gathered between 1950 and 1956 while the author spent several months working for the state as a beaver trapper. Unless otherwise indicated, photographs were taken by the author.

ACKNOWLEDGMENTS

I am grateful to Dr. E. Raymond Hall for his interest and counsel. The monetary support of the State Biological Survey of Kansas made this bulletin possible. Donations for traveling expenses were made by Mr. Floyd Amsden of Wichita, Kansas, and Mr. Grover Simpson of Salina, Kansas. These men deserve special thanks for their enthusiastic support of wildlife conservation in Kansas. I am also indebted to the following persons for numerous valuable suggestions: Dr. Gerald Tomanek, Fort Hays Kansas State College; Drs. Henry S. Fitch, and Sydney Anderson, both of the University of Kansas; Mr. L. Lew Henry, Lawrence, Kansas; Mr. Larry Wagner, Overland Park, Kansas; Mr. David C. Coleman, Game Biologist, Kansas Forestry, Fish and Game Commission; Mr. Pat Bryan, District Game Protector, Kansas City, Kansas; Mr. George Whitaker, District Game Protector, Atwood, Kansas; Mr. Dwight Snay, United States Fish and Wildlife Service, Oklahoma; and Mr. H. Bradford House, fellow graduate student, The University of Kansas. The author extends sincere thanks to Mr. Bret Waller who did the art work for the bulletin. Special appreciation is extended to my wife, Karen L. Henderson, who assisted me in typing the manuscript and in numerous other ways.

SUBSPECIES

The one living genus of beaver, *Castor,* is found in North America and Eurasia. *Castor fiber* of Europe and Asia closely resembles the North American *Castor canadensis* in size and appearance.

The species *Castor canadensis* is composed of a number of actually or potentially interbreeding geographic variants—subspecies. Hibbard (1933) and Black (1938) thought (1) that the beaver found in Kansas when Whiteman first arrived was the subspecies *Castor canadensis carolinensis* of the eastern United States, (2) that the subspecies *carolinensis* was extirpated by Whiteman before 1900, and (3) that by 1920 another subspecies, *Castor canadensis missouriensis,* invaded the state from the northwest. Also it is rumored that beaver were introduced from other states into Kansas after all the native stock had been trapped out. Cockrum (1952) and Hall (1955) suggested that beaver in Kansas today probably are descendants of the native beaver, *Castor canadensis missouriensis,* that remained in isolated colonies in the north-central and northwestern parts of the State. In the late 40's Hall compared skulls and skins of beaver taken in eastern Kansas after 1940 with corresponding material from Nebraska and the Dakotas. He detected no differences and used the name *C. c. missouriensis.* In 1960

J. Knox Jones, Jr., E. Raymond Hall, and I compared skulls of beaver collected in eastern Kansas in the period 1873-1906, beaver from the same area that had been collected in the period 1920-1960, five topotypes of *C. c. carolinensis* (used by S. N. Rhoads in preparing the original description) from North Carolina, and finally skulls of two adults from Talbot County, Georgia. We could not detect any differences between the two lots of specimens from Kansas collected before and after 1907. Except that specimens (AMNH 99403 and KU 39455) from Georgia were slightly larger than those of the same age of the same sex from South Carolina, we could not detect any differences thought to be significant between those two lots of specimens. But, in comparing the specimens from South Carolina and Georgia with those from eastern Kansas the latter were found to have the bony tube (external auditory canal) that extends laterally from the auditory bulla of greater diameter (externally and internally), and the distal fourth of that tube was more curved with the result that the distal end was more anterodorsal in position. It is concluded that the beaver now in eastern Kansas are descendants of native stock that was not completely eliminated in the eastern half of Kansas in the period 1870-1890, and that the correct subspecific name of the beaver of Kansas is *Castor canadensis missouriensis* V. Bailey. Skins of freshly caught beaver of native *C. c. carolinensis* and *C. c. missouriensis* need to be compared in order to learn if the two subspecies differ in color.

DISTRIBUTION AND NUMBERS

From October, 1959, through January, 1960, approximately 340 man-hours were spent obtaining information on the distribution and numbers of beaver in Kansas. Time or funds available did not allow one man accurately to census beaver in each of the 105 counties in Kansas. Two counties, Ellis and Douglas, were selected for intensive study. The remaining 103 counties were visited and the number of beaver in each was estimated on the basis of reports from county residents, available habitat and data gathered by spot checks on major streams.

Counting the numbers of colonies along a given stream and estimating the number of beaver in each colony is a practical way to determine beaver population. Three methods of censusing beaver colonies were employed. These were: (1) Cruising a stream by boat or canoe in October and November and counting the active colonies (as evidenced by food caches and/or isolated areas of activity); (2) flying in an airplane at an air speed of between 100-

FIG. 4. Beaver dam, as seen from 200 feet in airplane, in Smoky Hill River approximately 13 miles south and ¾ mile east of Ellis, Ellis County, Kansas. View is south across river flowing east.

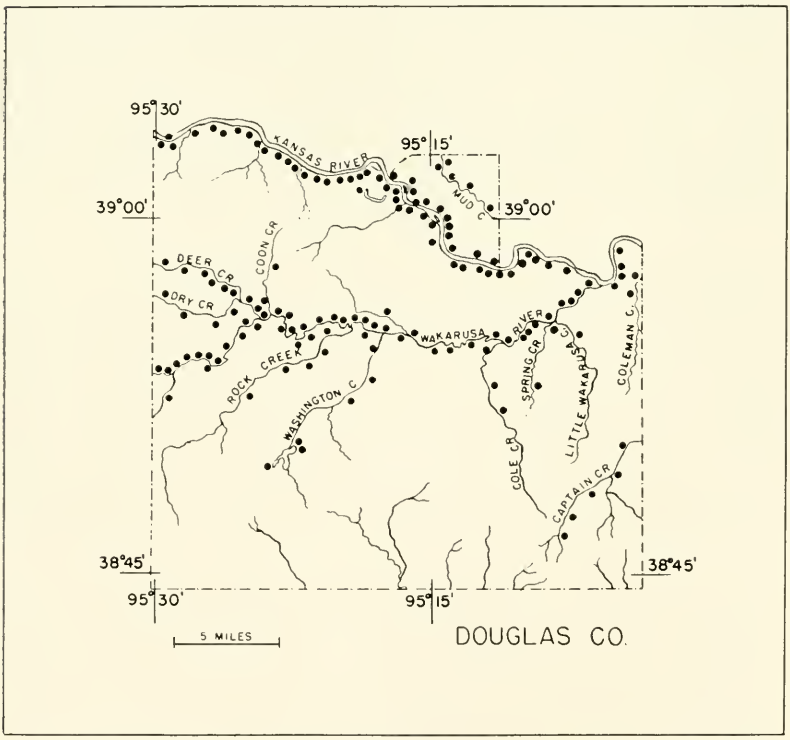


FIG. 5. Douglas County, Kansas, showing streams on which beaver were found in the winter of 1959-1960. A black dot represents a place where one beaver or more lived.

120 miles per hour at altitudes of between 100 to 200 feet, and counting beaver colonies as indicated by food caches and fresh cuttings; (3) traveling overland and spot checking the stream at two-mile intervals and interviewing landowners living along the particular stream.

These methods were tested on three streams where the beaver abundance is believed to be about equal. Nineteen beaver colonies were counted on approximately 14 miles of the Wakarusa River between a point 6½ miles west and 1½ miles south of Iowa and 23rd Streets, Lawrence, Douglas County, Kansas, to another point 2 miles south and ¼ mile east of Iowa and 23rd streets, by cruising the stream without the aid of a motor. This required approximately 7½ hours and the cost of the operation was $16.87 which included only one man's salary. The cost was $7.76 per 10 colonies counted.

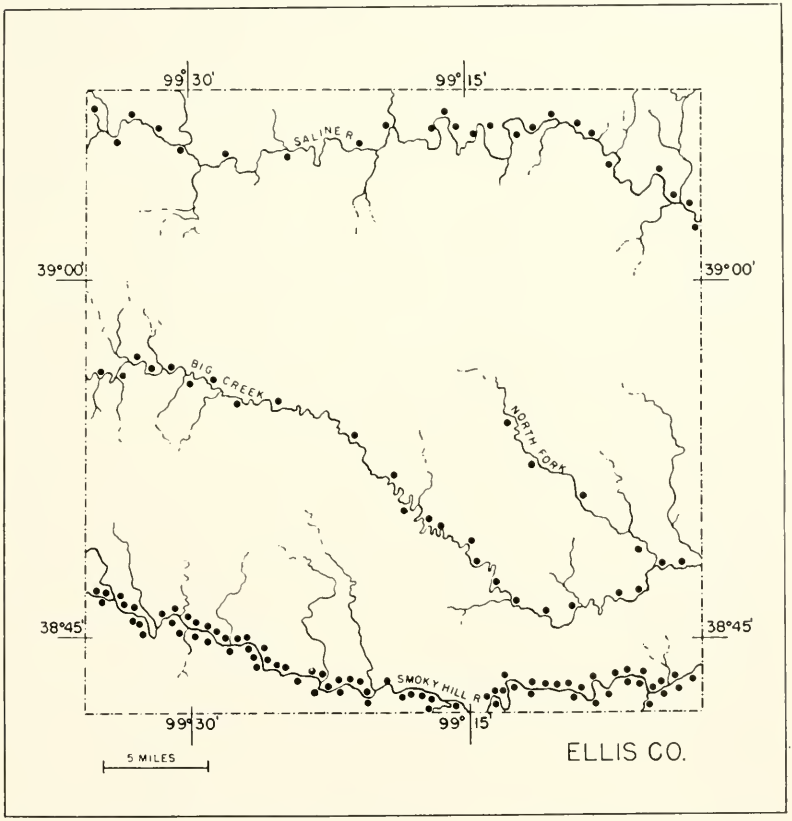


FIG. 6. Ellis County, Kansas, showing streams on which beaver were found in the winter of 1959-1960. A black dot represents a place where one beaver or more lived.

Seventy-five beaver colonies were counted in 32 minutes from the air along the Smoky Hill River that runs for 54.1 miles in Ellis County, Kansas. The cost for the 32 minutes was approximately $9.12 which included salary of observer, pilot and cost of operation of rented plane (Cessna 172). The cost was $1.22 per 10 colonies counted.

On streams where censusing by canoe, boat or airplane was difficult due to stream conditions such as on the Saline River, interviews with landowners and spot checks made along the river's 49-mile course in Ellis County adequately indicated the relative abundance of beaver on the stream. This operation required approximately eight hours and cost $25.62 which includes the salary of

TABLE 1.—DATA ON BEAVER IN AUTUMN OF 1959 IN DOUGLAS COUNTY, KANSAS. LENGTH OF STREAMS MEASURED BY MEANS OF CARTOMETER ON U. S. G. S. TOPOGRAPHIC MAP.

Name of stream	Length in miles	Number of colonies found	Estimated number of colonies	Estimated number of beaver	Method of censusing
Mud Creek	5.2	5	5	25	Airplane
Kansas River	34.4	56	56	280	Airplane
Oakley Creek	2.8	1	2	10	Spot check
Spring Creek	3.6	0	2	10	" "
Coon Creek	7.2	1	3	15	" "
Baldwin Creek	6.8	1	3	15	" "
Wakarusa River	43.6	46	46	230	Boat
Cole Creek	4.0	3	4	20	Spot check
Spring Creek	4.8	1	3	15	" "
Little Wakarusa Creek	18.0	3	6	30	" "
Coleman Creek	3.6	1	1	5	" "
Captain Creek	20.8	7	10	50	" "
Spring Creek	1.2	0	0	0	" "
East Fork Tauy Creek	1.6	0	0	0	" "
Middle Tauy Creek	2.8	0	0	0	" "
Eight Mile Creek	4.0	0	0	0	" "
Elk Creek	3.2	1	1	5	" "
Rock Creek	24.4	6	10	50	" "
Washington Creek	17.2	7	10	50	" "
Unnamed creeks	2.2	2	2	10	" "
West Fork Tauy Creek	5.2	0	0	0	" "
Chicken Creek	6.0	0	0	0	" "
Wymore Creek	1.2	0	0	0	" "
Yankee Tank Creek	5.2	1	5	25	" "
Coon Creek	4.0	2	3	15	" "
Deer Creek	4.8	6	8	40	" "
Dry Creek	4.0	2	3	15	" "
	241.8	152	183	915	

one man and cost of operation of one vehicle. Out of the 27 spot checks made, 24 beaver colonies were counted and all five landowners interviewed indicated beaver to be numerous along the river. The cost was $10.68 per ten colonies counted but only $5.01 per ten colonies estimated. This method does not provide data so accurate as does method one or method two.

Censusing by airplane (Fig. 4) proved to be an inexpensive and quick method whereas censusing by means of a boat proved to be the most reliable. Both of these methods should be used. The third method must be used when conditions on a stream prevent use of the other two methods.

Denney's (1952) study indicated that there are approximately five beaver per colony in the United States. For the purpose of my study the number of colonies was multiplied by five to determine numbers of beaver in each county of Kansas.

Approximately 242 miles of streams are suitable for beaver in Douglas County. Most of the beaver are on the two larger rivers, the Kansas River and the Wakarusa River. As shown in Figure 5, beaver colonies were found also along smaller streams including: Captain Creek, Cole Creek, Spring Creek, Little Wakarusa Creek, Washington Creek, Rock Creek, Dry Creek, Deer Creek, Coon Creek, and Mud Creek. Beaver were found on still smaller unnamed streams. The author found 152 colonies in Douglas County and almost certainly there are more. Table 1 shows each stream with data pertaining to its length, number of colonies found, estimated number of colonies, method of census and number of beaver per stream. The estimated number of colonies in Douglas County is 200 or one colony per 1.2 miles of suitable stream.

The total miles of stream suitable for beaver occupancy in Ellis County was found to be approximately 162.0. As shown in Figure 6, Ellis County lacks small streams suitable for beaver and most of the beaver were found on the three major streams: The Saline River, the Smoky Hill River, and Big Creek. Beaver were found also on North Fork Creek, Wanmadden Creek, Big Timber Creek, Eagle Creek and Duck Creek, but the colonies of beaver on each of these creeks with the exception of those on North Fork Creek were within one mile of the main tributary into which the small stream feeds. Table 2 shows the data pertaining to each stream in relation to beaver abundance. One hundred and thirty-three colonies were located in Ellis County. Since spot checking was used on both

Table 2.—Data on Beaver in the Autumn of 1959 in Ellis County, Kansas. Length of Streams Measured by Means of Cartometer on U. S. G. S. Topographic Map.

Name of stream	Length in miles	Number of colonies found	Estimated number of colonies	Estimated number of beaver	Method of censusing
Saline River	49.0	24	50	250	Spot check
Smoky Hill River	54.1	75	75	375	Airplane
Big Creek	44.4	26	40	200	Spot check
North Fork Creek	11.0	4	6	30	Spot check
Big Timber Creek	1.8	2	2	10	Spot check
Eagle Creek	1	0	0	0	Spot check
Wanmadden Creek	.5	1	1	5	Spot check
Duck Creek	.5	1	1	5	Spot check
Totals	162.3	133	175	875	

Big Creek and the Saline River many more colonies exist than are indicated in Figure 6. The author estimated that there are at least 175 colonies of beaver in Ellis County or a little more than one colony per mile of suitable stream.

It seems that there are more beaver per mile of suitable stream in Ellis County than in Douglas County. If there are more beaver per mile of stream in Ellis County, the larger number of cottonwoods and willows, their preferred food, may be the reason. In the eastern part of the state many of the stream banks have dominant growths of elm, walnut, hickory, and oak. These are not considered to be suitable food for beaver.

According to Schoewe (1951) sixteen streams in Kansas bear the name "Beaver." Beaver were found living within the city limits of the following cities in Kansas in the autumn of 1959: Kansas City, Lawrence, Topeka, Salina, Hutchinson, and Wichita. That same year beaver were found living on several man-made lakes in Kansas. The large reservoirs, such as Kanopolis in Ellsworth County, Cedar Bluff in Trego County, and Kirwin in Phillips County all have some colonies of beaver living along the shorelines. There seems to be a pile-up of beaver below the large dams, especially below Kanopolis Dam and Cedar Bluff dam. Colonies of beaver first appeared in Kanopolis Reservoir between 1953-1955 and in Cedar Bluffs Reservoir between 1956 and 1958. Refuge Manager, Mr. Larry Means, said that there were two colonies of beaver on the North Fork of the Solomon River at the site of Kirwin Reservoir prior to the time the reservoir began to fill in 1952. In the autumn of 1959 there were 12 colonies of beaver living along the

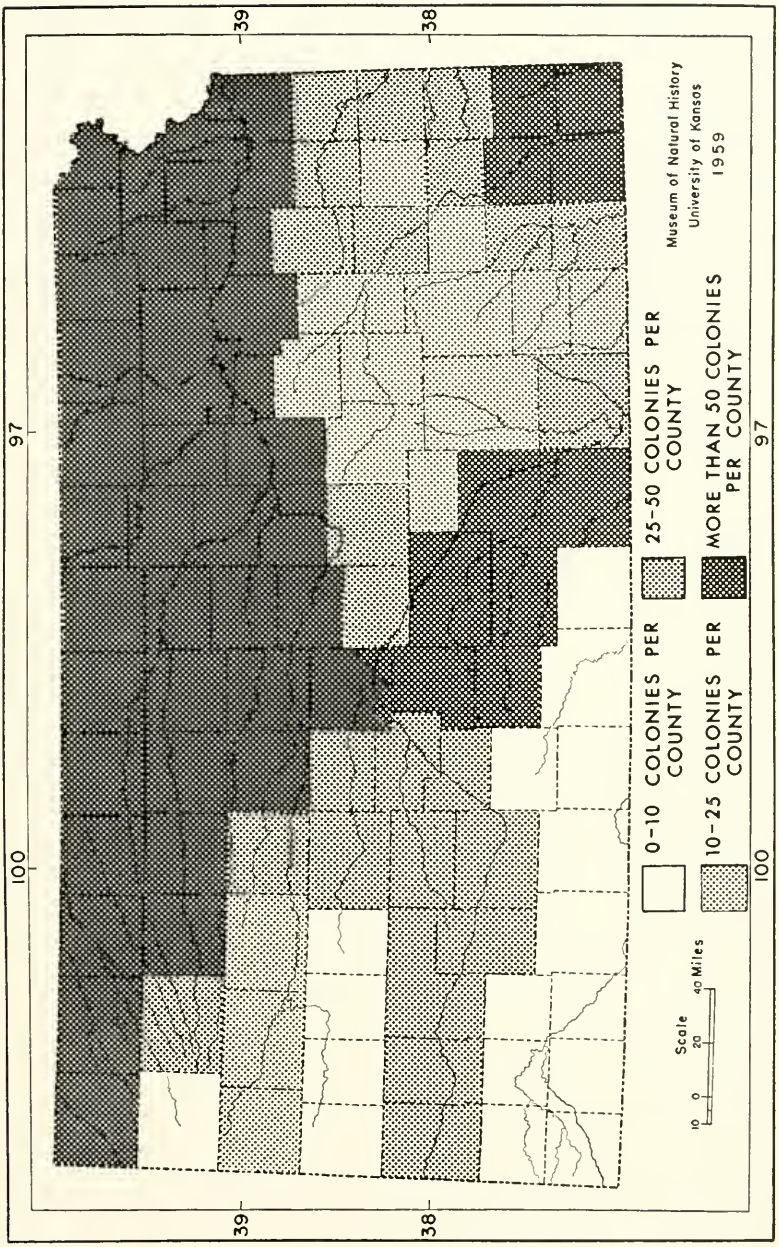


FIG. 7. Distribution and estimated number of colonies of beaver in Kansas by counties.

shoreline of Kirwin Reservoir. Several state, county and city lakes support colonies of beaver. Some of these lakes are: State lakes in Crawford, Scott, Kingman, Ottawa, McPherson, Miami and Graham counties; county lakes in Douglas, Johnson, Stafford, Pratt, and Sedgwick counties; and city lakes near Gardner and Olathe. Beaver often establish colonies on smaller lakes, such as the Strip-Mine Lakes in southeastern Kansas. One colony in Ellis County lived in a farm pond having 3 acres of surface and another colony in Johnson County lived in a farm pond having less than one acre of surface.

Beaver were found along all the principal rivers in Kansas, in both the Missouri and Arkansas river basins. Considering the five major river systems, the Missouri, the Kansas-Smoky Hill-Republican system, the Marais des Cygnes, the Arkansas, and the Cimarron, beaver are most abundant on the Kansas-Smoky Hill-Republican system and least abundant on the Cimarron system. The principal streams in each of the Kansas counties are listed in Table 5 on pages 65-82. Those streams known to support beaver are marked with an asterisk.

Beaver probably re-established themselves too short a time ago in Kansas to have yet explored all streams suitable for occupancy. No systematic records were kept of the numerous transplantings between 1930 and 1959; therefore, it is impossible to evaluate the relative effects of transplantation, natural movements of beaver, and limitations of habitat. At least fifteen counties now lacking large populations of beaver probably have suitable habitat to support such populations. These counties are: Harvey, Lyon, Chase, Butler, Morris, Marion, Chautauqua, Greenwood, Woodson, Elk, Harper, Barber, Comanche, Clark, and Kiowa.

Of the 105 counties in Kansas, permanent populations of beaver are found in 100. The map, Fig. 7, shows the number of beaver estimated to exist in Kansas. The number of beaver in the state as a whole is conservatively estimated to be at least 23,000.

HISTORY

The earliest known fossil beaver lived in the Oligocene Epoch, 40 to 50 million years ago. According to the Paleontologist, Stirton (1935:chart 2), the origin of our present day beaver, *Castor,* is not definitely known. *Steneofiber,* appearing in the middle Oligocene Epoch of Europe, has been identified as the first known ancestor of the modern beaver (Warren, 1927). *Steneofiber* is not known to have lived in North America, and therefore if *Castor* is descended from *Steneofiber, Castor* probably immigrated from Eurasia across the land bridge that from time to time spanned the existing Bering Strait, between Alaska and Siberia. Further evidence to support this theory is that bones of the genus *Castor* first appeared in the fossil record in the Pliocene Epoch, one to ten million years ago in Europe, but in North America records first appeared later in the Pleistocene deposits (laid down less than a million years ago).

A giant beaver skull, shown in Fig. 8, was found three and one-half miles southwest of Boicourt, Linn County, Kansas, around 1900 and the skull is on display at the Museum of Natural History at the University of Kansas at Lawrence. In the Upper Pleistocene, *Castor* was widespread in North America. The giant beaver that also lived then belonged to the genus *Castorides,* subfamily Castoridinae, and was exclusively a North American mammal. Other specimens have been found in many parts of the country from central New York to the Great Plains, north to Minnesota and south to Florida (Warren, 1927). Entire skeletons of the giant beaver measuring seven and one-half feet long have been uncovered (Lane, 1947). Hay (1914) believed that large specimens probably reached a length of eight or even nine feet.

What was supposed to be the house of a giant beaver was discovered near New Knoxville, Ohio, in 1889 (Warren, 1927:15). The house was approximately eight feet square, between three and four feet high and built of willow poles averaging three inches in diameter laid in the manner in which beaver lodges are constructed at the present time. The giant beaver's habits probably closely resembled those of the modern beaver. The giant beaver probably built huge dams across the Pleistocene streams of Kansas.

Prior to the time of the arrival of the Whiteman the beaver population of the entire Western Hemisphere probably had adjusted

Fig. 8. The now extinct Giant Beaver (skull on the right, No. 3196 K. U.) lived in the Marais des Cygnes River Valley, years ago. The skull on the left is that of a present day beaver taken from the Marais des Cygnes River in 1956 (No. 81772 K. U.).

itself to the environment, and within limits was subject to much the same controls as were the other species of mammals, man included. Of course no one can say for certain how many beaver lived in the territory that now comprises the state of Kansas before the coming of the Whiteman, but a figure of 50,000 would not seem to be excessive in comparison to the population today and in view of conditions believed to have existed then.

Before the arrival of the Caucasians in North America three tribes of Indians are thought to have lived permanently on Kansas soil, and other tribes are thought to have frequently hunted here.

The Pawnee made their permanent home in the western half of the state, the Kansas Indians lived mostly in the northeastern quarter and the Osage Indians lived in the southeastern quarter. Beaver meant many things to the different tribes. The Osage and Pawnee each named one division of their tribe, "The Beaver People." Indians had many traditions and legends pertaining to beaver. Most of the legends concerning beaver dealt in some manner with the creation of the world. Some tribes possessed the medicine bundle known as the beaver bundle, which was supposed to have supernatural powers. The Indians killed beaver for food and used their skins for clothing; but the Indians attached no special trade value to them before the time of the Whiteman.

The Indians used bows and arrows, spears, snares and deadfalls to obtain beaver. Sometimes the Indian would set his snare and then hide a short distance away. Attached to the snare was a rattle made of dried deer hoofs, which informed the Indian that the snare had been sprung. The Indian then could kill the captured animal with a spear or club. According to McCracken and Cleve (1947:3) the Indian's snares sometimes were woven into the form of nets. Such a device was popular among the Indians for trapping beaver. The net was generally about twelve feet long, six feet deep, and of four-inch mesh; a draw cord around the edge, when pulled, brought the net together forming a closed bag. The net was set in the underwater path used by the beaver in leaving their den. When the net was in place, the Indian would break into the den and the fleeing animals would become entangled in the net and drown.

The human population was then not large enough to exert harmful pressure upon the beaver population as a whole nor did there exist the incentive or the means for rapidly harvesting more beaver than were needed. This was drastically changed by the coming of the Caucasians who brought an iron-age economy into a continent that was dominated by a stone age culture. The Whiteman's invasion of North America not only altered the natural conditions, but soon caused the Indians to modify their own ideas (Presnall, 1943).

The first Whitemen to visit Kansas were Spaniards, who came by way of Mexico in 1541. They later settled in what is now New Mexico, and probably were the only Whitemen to trade with the Indians of Kansas for one hundred years thereafter. The Spaniards traded with the Indians for beaver and other pelts giving in exchange knives, axes and sheet steel, which the Indians used for

making arrow points. According to Chittenden (1935) the Spaniards never figured prominently in the American fur trade, because their operations were limited to the southwest.

Bright (1956:16-30) indicates that the French entered the territory now comprising the state of Kansas around 1719 when Charles du Tisné negotiated with Indians. The Mallet brothers were in Kansas in 1739. Almost certainly the French traded with the Indians in this period.

The most important factor in the early fur trade was the presence of the Indians. They controlled the whole system of conducting business. To a considerable extent the Indians were themselves the producers, for they trapped the fur and traded the pelts in exchange for whatever the French had brought to trade.

Up until 1775 the fur trade in Kansas was carried on by rival traders, mostly Frenchmen. Soon afterwards new competitors, Americans of British origin, like James McKay, Andrew Todd and John Evans entered the trade. Beaver pelts were used as a medium of exchange. Frontiersmen like Daniel Boone, George Morgan, and Davy Crockett pressed across Kansas and into the mountains where new supplies of beavers were discovered. The rivers of Kansas soon became trails to the far west. In 1786, Auguste and Pierre Chouteau established trading posts along the major rivers of Kansas. Explorations of Lewis and Clark, Pike, Long, Fremont and Becknell encouraged the exploration of the fur resources of the West. Men such as Jim Bridger, Kit Carson, Sharp Grover, Billy Comstock, Billy Williams, Pierre Trudeau, Ben Clark and an increasing number of other trappers intensively harvested beaver pelts.

Between 1800 and 1850 a number of events tremendously affected the Kansas beaver population. The Indians gradually became dependent upon the ways of the Whitemen. In 1825 Kansas was a large section of the area termed Indian Territory by Congress, and many of the eastern tribes were forced to migrate into this territory. Although these immigrants and the native Indians were somewhat civilized they continued to live mostly on deer, elk, and buffalo, and to barter beaver pelts. In 1823 steel traps, previously almost unknown, became an industrial product of this country. The steel trap enabled the beaver trapper greatly to increase his yearly catch. In 1829, Frederick Chouteau took 400 fur packs to St. Louis. These pelts were taken on the Kansas River and its tributaries. The packs contained beaver, otter and muskrat and were worth not less than $100,000 on the St. Louis market. Had the packs contained all beaver, the cargo would have been worth $208,000.

Most of the beaver pelts were shipped to Europe. Until 1842 in Europe beaver fur was used principally for making felt for the manufacture of beaver hats, which then were popular. As early as 1638, Charles I of England issued a proclamation prohibiting the use of any material except pure beaver wool in the manufacture of such hats. The introduction of the silk hat reduced the early American fur trade to an all-time low. In 1846 one beaver pelt on the London market sold for only 85¢; in 1839 the same pelt would have sold for $5.87. The decline in the fur trade should have benefited the beaver population. Although the trade slowed down, the only way of life for a considerable number of Whitemen and Indians was hunting and trapping. Grinnell (1923:67) states that when beaver trapping ceased to be profitable, many American and French trappers left the mountains and settled along the Arkansas River in what is now Colorado. By 1846 the population of the beaver in Kansas was probably not much higher than 20,000.

From 1850 to 1900 the beaver population dwindled steadily as trappers continued to take beaver from Kansas waters. This contributed to the near extermination of the beaver. A common practice was the trapping of beaver in two seasons a year, in autumn and again in spring. In winter the climate was too severe for effective trapping of beaver, the peril of travel was extreme, streams were frozen over, and the activity of the beaver was greatly reduced. The cold of winter seems to add quality to the fur, and pelts taken in spring are fully prime.

Competition soon caused trappers to take fur in all seasons and to leave no beaver in many streams. Knox (1875:22) reported that beaver were common along most of the large streams, but were getting scarce in the eastern part of the state. Kellogg (1915, unpublished manuscript) reported that Mr. Jay Swink who trapped near Timber Canyon Ranch in Scott County collected nearly two hundred beaver pelts from creeks in that vicinity in 1884. Baker (1889:57) wrote that the beaver in western Kansas was rapidly disappearing.

According to Cockrum (1952), Mr. Billy Wilson and two companions spent several months trapping for furbearers in north-central and northeastern Kansas in 1899-1900. They left Fairbury, Nebraska, and went downstream on the Little Blue to the Big Blue, upstream on the Big Blue to the Kansas-Nebraska line, then down stream again to the Kansas River and down that stream to Lawrence, Kansas. The only fresh sign of beaver seen on the trip was that of one family of beaver on the Little Blue above Manhattan at

the mouth of Walnut Creek. However, in talks with other trappers Wilson heard of scattered colonies of beaver on the Republican River.

In 1905 Lantz wrote that beaver were common along some streams of Kansas as late as 1880 but that beaver had become rare. Dyche (1907) reported that there was no law protecting beaver and that the old beaver trappers would travel one hundred miles to get just one last beaver, each trapper making the excuse that if he does not catch the last beaver, the other fellow will. On November 12, 1907, a beaver was trapped near Lawrence, Douglas County, Kansas. At that time this beaver was believed to have been the last beaver in Kansas. Nevertheless between 400 and 500 beaver probably were left in isolated colonies in the north-central and northwestern part of the state.

The first Kansas law protecting beaver was passed by the State Legislature in 1911 and provided closed seasons for ten years from the date of its enactment on March 25. Dr. E. Raymond Hall reported that he saw fresh beaver sign on the Wakarusa River south of Lawrence, Douglas County, Kansas, eight years later in 1919. On March 21, 1921, Senate Bill 352, became law and provided for a closed season on beaver until the Department of Game decided otherwise. Later, in 1924, J. B. Doze (1924:19) reported that beaver are "in the Republican, Saline, Arkansas and Solomon valleys, being more numerous in the Republican valley, where complaints have been made against them."

In 1927 the legislature enacted a law requiring fur dealers to purchase licenses. This law eliminated much illegal trapping. Also in 1927 a law was enacted to protect beaver dens and dams from being destroyed by trappers. In 1929 permits were issued to landowners to trap and sell beaver pelts, but probably many complaints were made in order to trap and sell the pelts rather than because of damage by the beaver.

In the Third Biennial Report of the Kansas Forestry, Fish and Game Commission (Clapp, 1930) it was recorded that beaver were then doing considerable damage along the Republican, Blue, Solomon, Saline, Smoky Hill and Kansas rivers. Landowners in several instances were unable to catch the beaver; therefore the Game Commission hired eleven trappers on a full-time basis, paying each one-half of the total price of the pelts taken by him. Only three of the eleven men were able to take enough beaver to make the program worthwhile to them. The Game Commission was si-

multaneously receiving numerous complaints of beaver damage and requests for beaver stocking from south-central and eastern Kansas. Operations were begun in 1930 to transplant beaver in the state. No records were kept and in 1930 the Third Biennial Report reported that the system of transplanting beaver was not satisfactory because the transplanted beaver would not remain where they were released.

Subsequently the Game Commission continued to employ trappers at a salary of one half of the take, to allow some landowners to take beaver upon permit, and to permit Game Protectors to pelt beaver. Those pelts were sold at public auction by the state.

From 1930 to 1950 the Commission transplanted beaver from one section of the state to another. In this period the beaver population continued to increase and spread. Cammack (1932) reported that beaver were increasing. Strong in 1935 reported that complaints against beaver were mounting as their population continued to increase. In 1936 Hans reported that the number of beaver was enormous. According to Roy Wall (1939) a careful survey was made in the months of November and December, 1937, and the beaver population of Kansas was conservatively estimated at 1,500. Most of these were reported to be in the two northern tiers of counties extending from the Colorado line east to Marshall and Pottawatomie counties. Some beaver were found east and south of this more heavily populated area.

In 1941 the Eighth Biennial Report of the Kansas Forestry, Fish and Game Commission (Josserand, 1941) recorded that public opinion concerning the management of beaver was widely divided. The report stated that transplanting beaver had been stopped and that hired trappers were pelting all the beaver being taken from areas where complaints were made against their activity.

The Tenth Biennial Report of the Commission (Anonymous, 1945) stated that some beaver were being transplanted and that others were being pelted. In the winter 1946 state trappers pelted 406 beaver, and the Forestry, Fish and Game Commission paid the trappers in the same period salaries totaling $3,092.52. The Com-

mission sold the same 406 pelts for $13,544.33. The number of trappers and the salaries of each individual were not recorded with the above information in the Eleventh Biennial Report of the Forestry, Fish and Game Commission (Leahy, 1947).

In December and January of 1951-52 the Kansas Forestry, Fish and Game Commission declared the first open season for trapping beaver since the law protecting beaver was enacted in 1911. According to records of fur buyers, approximately 3,000 beaver were trapped in the state that year. The reduction of the population evidently was not great, for the Commission received many complaints (Lutz, 1954, *in litt.*) in 1953 and 1954. In the absence of information as to the proper preparation of beaver pelts, many

trappers pelted beaver improperly. This resulted in an average loss of several dollars per pelt (Hall, 1955:118). The beaver season was again closed during 1952 and 1953. State trappers attempted to eliminate beaver where they were causing damage. The Commission again opened the beaver season for the months of December and January in 1954 and 1955, because of an increasing number of complaints. Drought at the time may have concentrated the population and aggravated the situation locally. Fur dealer reports indicated that a total of 6,000 beaver were taken in the 1954-55 season. The season was opened again in December and January of 1955-56.

In the autumn of 1956 landowners and some trappers were given special permits to trap and sell beaver pelts from areas where beaver were reportedly causing damage. Game Protectors trapped some beaver where other trappers refused to trap the beaver because of existing low prices received for pelts. According to Fred Warders, Assistant Director of the Kansas Forestry, Fish and Game Commission, each district protector was instructed to sell pelts and turn the money from the sale of these pelts into the Forestry, Fish and Game headquarters at Pratt. This system was continued through the 1956-57 and 1957-58 trapping seasons, but in the records at Pratt I found an accounting for only ten beaver pelts for the 1956-57 season and 19 for the 1957-58 season. Almost certainly more beaver were harvested. Once again in August, 1958, the Forestry, Fish and Game Commission decided to open the beaver trapping to the public. The season was set for January, 1959.

Faced with an increasing number of complaints and few people willing to trap beaver, the Commission opened the beaver season for the months of January and February, 1960. According to fur buyers beaver pelts do not become prime until February in Kansas, except possibly in the northwestern section of the state where they may become prime in late January. Harvesting of unprime pelts results in a loss of several dollars per pelt. Opening of the season in January and February, when pelts would be prime, was an attempt to encourage the taking of a larger number of beaver.

ECONOMIC IMPORTANCE

An appraisal of the beaver's value should take into account not only the monetary value of the pelts, but also the action of beaver dams in preventing rapid runoff, conserving water, stabilizing stream flow, decreasing erosion, and improving and creating habitats for other species of wildlife. From 1951-59 beaver pelts taken in Kansas continued to decline in price; consequently many trappers turned

Table 3.—Price [1] of Blanket Beaver and Number [2] of Beaver Caught in Kansas in the Period 1929-1960

1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942
$30	$27	$18	$11	$9	$14	$11	$11	$19	$15	$18	$25	$32	$29
66	280								30			368	292

1943	1944	1945	1946	1947–48	1948–49	1949–50	1950–51	1951–52	1952–53
$35	$50	$35	$63	$36	$50	$40	$31	$35	$26
350	246	218	205	237	269	355	700	3000	700

1953–54	1954–55	1955–56	1956–57	1957–58	1958–59	1959–60	1960
$16	$22	$23	$21	$19	$14	$16	$20
400	6000	3416	10	19	1324	1222[3]	

[1] From actual sales of Blanket beaver in New York City by New York Auction Co., Inc., and by United Fur Brokers. Prices received by the trappers for Grade No. 1 skins should have been 10% less than those listed here on account of a 3-5% sales commission in New York City and a 5-7% profit for the local fur buyer. "Average lots" of pelts of all sizes, of No. 1 grade, sell for approximately one-fourth less per pelt than the Blanket size (see page 62).

[2] Data on number of pelts are from State of Kansas Forestry, Fish and Game Commission, which receives reports from local fur dealers.

[3] Lacking reports from 4 of 46 licensed fur dealers.

their attention to other furbearers whose pelts yielded a higher return. The value of beaver pelts is indicated in Table 3 for the years 1929 through 1960.

In the latter part of the 1960 beaver trapping season, prices paid for properly-handled pelts of blanket beaver increased to $20. Indications are good for a continued incentive for trappers to harvest beaver from areas where game managers ascertain that the supply is adequate.

The alterations, of the environment, caused by beaver may be either beneficial or harmful to man and each case needs to be evaluated separately. The building of dams gives beaver economic importance. In many places beaver dams built across streams raise the water table. This increases the yields of grasses from land adjacent to beaver ponds (Fig. 9). According to Mr. Richard Hollister, owner of a ranch in Logan County, Kansas, after a pair of beaver was released on a creek in one of his pastures the beaver built several dams and from the resulting ponds cattle obtained a water supply. Mr. Hollister said "When the food supply of the beaver began getting low the beaver cut down some large cottonwood trees that I hoped would be saved, but then my cows don't eat trees and as a result of the impounded water this pasture has improved because of the increased grass yields and permanent water supply."

Farmers also draw irrigation water from beaver ponds and are spared the expense of constructing dams of their own. This was especially true during the recent drought years. During these years there was considerable evidence that beaver rendered a valuable service to cattlemen by building dams and holding water in small streams that might otherwise have become dry in summer. According to Mr. Sid Sanders, who operates a farm along the north fork of the Ninnescah River in Reno County, "There is a small tributary of the river that runs near my house and prior to the time the beaver appeared on this branch, it was normally dry by midsummer. Since the beaver have been there, a steady flow is maintained throughout

Fig. 9. Beaver dams create ponds and thereby raise the level of the ground water of adjacent land. Grass yields are higher as a result. Francis Jordan (pictured) often fishes and swims in this beaver pond. Photo taken 1 mile southeast of Russell Springs, Logan County, Kansas, August 22, 1959.

the summer months." Because of this conservation of water, Mr. Sanders regards the beaver as a valuable asset to his farm.

Fishermen are well aware of the benefit from beaver impoundments that often provide the only good places to fish, especially on small streams in the western half of the state. Deeper water impounded by beaver normally results in: (1) A greater amount of plankton, which increases the amount of food for fish; (2) winter protection for fish; and (3) habitat where none existed before for a variety of animals.

The beaver has been called the original flood control engineer. By building series of dams across small water courses he has helped to control water levels and reduce floods on those streams. Beaver keep dams in constant repair and the dams withstand the ravages of minor fluctuations in stream flow. By building dams, beaver aid materially in reducing soil erosion in certain areas. The running water that enters a beaver pond slows down and automatically drops its load of silt. In time, the pond fills up with silt, forms a meadow and thus keeps the soil there. Otherwise, fine silt suspended in running water would be carried far downstream and perhaps on into the ocean.

The invasion of a stream by beaver usually results in an ecological succession that provides habitats where increased numbers of plants and animals can exist (Fig. 10). The water in beaver ponds provides fish of many kinds with spawning places and/or over-wintering sites. The water is utilized by stock, deer, waterfowl, muskrat, raccoon, mink, quail, pheasant, and many other kinds of wildlife. The increased variety and amount of vegetation that normally grows around a biologically balanced beaver pond furnishes habitats for various insects, many of which are used as food by fish in the pond. Shrews, meadow mice, and other small mammals invade the area and become established. Ducks and other waterfowl find nesting sites around the pond. As a result of flooding, some trees die; their limbs soon break off and fall from the dead trunks and allow the entrance of moisture and fungus, which form holes. Woodpeckers drill other holes in the dead trunks. Those holes provide essential nesting sites for tree swallows, crested flycatchers, bluebirds, titmice and other kinds of birds (Hall, 1955:116).

Even after beaver have abandoned a pond, their burrows become homes for other kinds of wildlife. Sometimes well-built beaver dams remain long after the beaver have left and the permanent pond continues to serve the needs of other species of animals.

In places where the water is deep enough to meet the needs of beaver without their having to build dams, the beaver affect plants and other animals less than in areas where dams have to be built. The activities of beaver may in some such places be detrimental to man. The habit of digging burrows causes a variety of complaints. Heavy farm implements driven along the edges of rivers or creeks have broken through into the burrows. Man-made ponds are sometimes drained when beaver tunnel into the earthen dams. Beaver dens and tunnels cave in and cause the banks of streams to cave in. In one instance a calf fell into a den and died.

Other complaints generally fall into one or more of the following

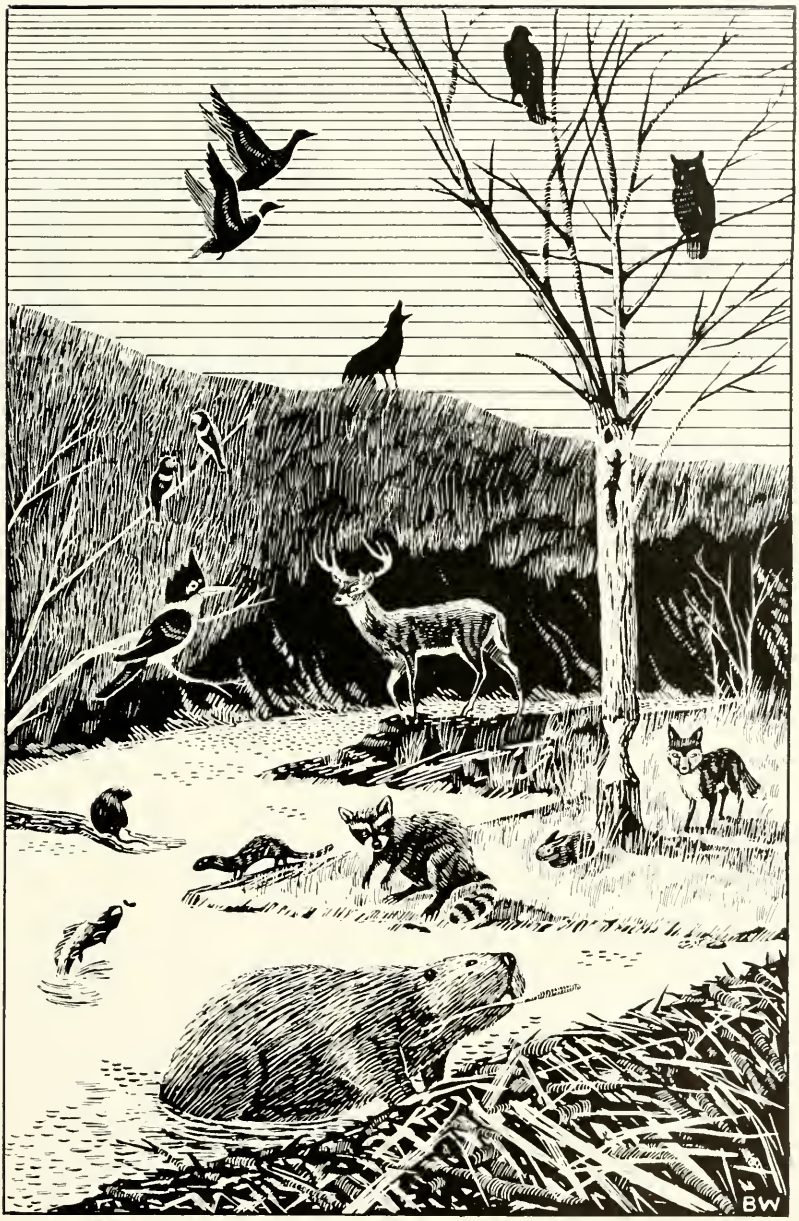


FIG. 10. Many animals benefit when a colony of beaver build dams thereby creating ponds.

categories: land is flooded (Fig. 11), too many trees are cut, crops (mostly corn), are damaged, irrigation ditches are stopped. Other complaints arise when fishermen find their bank lines cut by beaver, or when commercial fishermen along the Missouri River find their

Fig. 11. Roadway flooded by water that was backed up by beaver dam to the right of the picture. Flooding of land by beaver and their dams often causes complaints. Photo taken 4 miles south of Antonio in Ellis County, Kansas, on November 27, 1939.

nets damaged where a beaver has become entangled and cut its way out. In some places beaver dams back water up where it is not wanted. Destruction of a beaver dam rarely corrects the situation because the beaver almost always rebuild the dam. In some such instances the water is said to have been kept below a harmful level by means of a pipe inserted through the dam. The intake-end should be 20 feet upstream from the dam and covered with large boulders. Where it is desired to prevent beaver from cutting certain trees, painting the trunks with creosote or inclosing them in heavy woven wire to a height of four feet is said to have been effective.

Many owners of bottom land fear the damage that beaver may do, and complain because of this fear rather than because of actual damage. In areas where beaver do cause damage they can be removed to a more suitable habitat, or the population can be reduced by harvesting pelts of an appropriate number. Where beaver serve a valuable purpose the life of each colony should be prolonged.

MANAGEMENT

Management of beaver in Kansas has been geared to the number of complaints. District Wardens are responsible for the methods used in meeting complaints. These methods include: (1) Transplanting beaver from one area to another with no system of tagging the animals or keeping records of the transplants; (2) trapping and pelting beaver; (3) permitting certain trappers to take beaver in areas from which complaints have been received; and (4) permitting landowners to trap, shoot, or otherwise dispose of beaver. This system results in an increasing number of complaints.

The author recommends that the state be divided into beaver management areas, such as those suggested in Fig. 12. The Forestry, Fish and Game Commission should increase the number of trained persons in the Game Division and establish Furbearer Management as one duty, section or subdivision. The personnel of this subdivision should ascertain (1) the approximate number of beaver in each area to be managed; (2) the rate of increase; (3) the causes of mortality; and (4) the availability of food for beaver.

When this information has been obtained it may be apparent that a fairly regular harvest is possible or necessary in some areas. The harvest should be controlled by a flexible system of open and closed areas. When a harvest in a given area is decided upon, the landowner, or his agent, and an employee of the Game Department can estimate the number of beaver appropriate to be trapped from a given stream.

If the landowner or his agent elects to harvest the beaver himself he should be licensed to catch the number agreed on and to retain all of the proceeds. If he prefers that someone else harvest the number agreed on, an employee of the Game Department, in years when prices of beaver warrant departmental participation, should do so—the Department receiving half of the proceeds and the landowner the other half.

By thus profiting financially from a natural resource, landowners encourage and conserve beaver. Landowners weigh inconvenience or damage caused by beaver against income from the sale of their pelts and make fewer or no complaints to the Department.

In years when the price of beaver and/or their pelts is so low as to make harvesting them unattractive, a few Demonstration Trappers employed by the State Department can demonstrate effective trapping techniques to landowners and tenants who complain that beaver are causing damage. If the damage warrants, the person

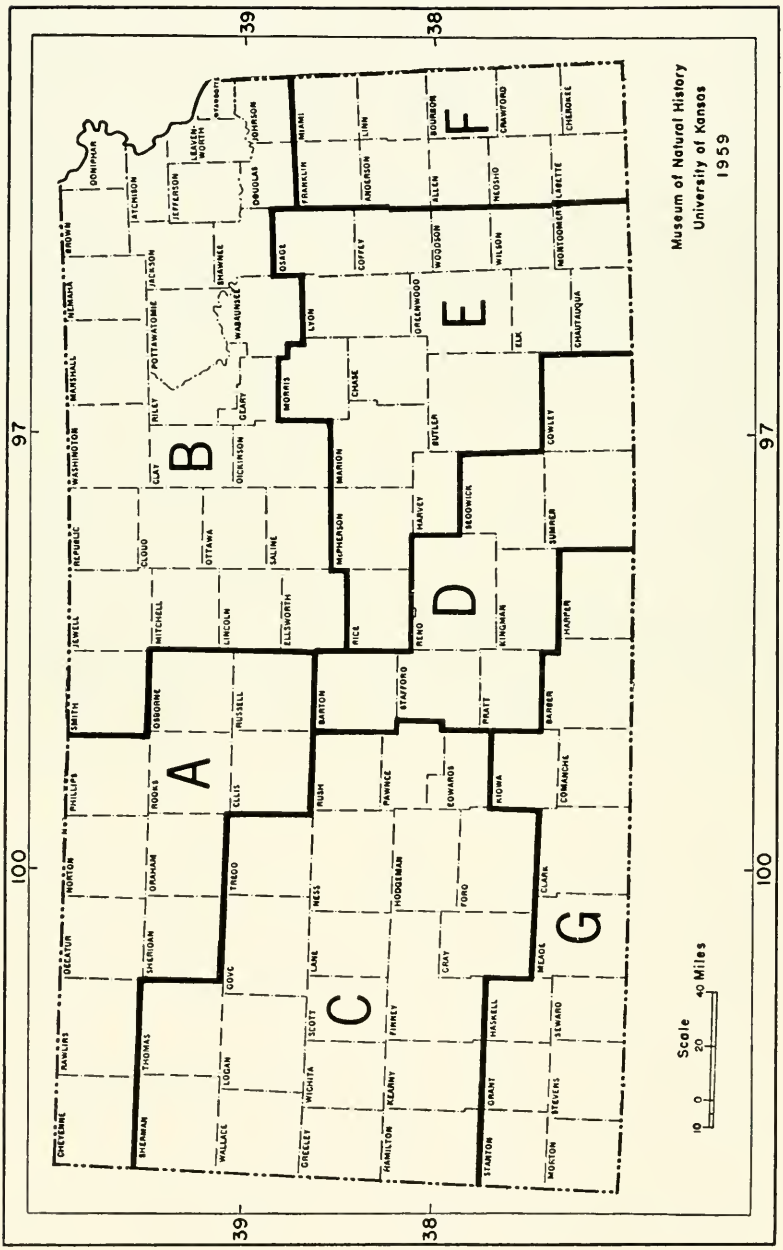


FIG. 12. Map of Kansas showing proposed management areas.

whose interests are damaged can trap and destroy offending beaver under permit and so solve his own problems without governmental subsidy. If the Game Department actually needs beaver for transplanting, the Department, of course, should have first opportunity to catch the unwanted beaver alive.

Some parts of the plan outlined above have worked well where tried and have brought deserved public approval to the state agency concerned because the plan (1) increases the natural wealth of the state, (2) enables landowners and tenants to increase their annual incomes, and (3) uses beaver to conserve water and to improve habitat for fish and other game.

Transplanted beaver should be tagged. Tagging enables the wildlife biologist to learn about migration, growth rate, sex ratio, sizes, weights and other individual characteristics of beaver. Information on these matters is useful in making and in administering an economically profitable management plan. An educational program to inform the public of the beaver's net worth economically and ecologically as well as aesthetically would be of great value. Money received from the sale of trapping licenses and possibly some funds from the Pittman-Robertson Federal Aid program, could be used for the establishment and maintenance of the needed Furbearer Management Section.

What happens to the beaver populations in the future is mainly up to the people of Kansas. An American tradition, one with legal substance, is that wildlife is a public possession even though the animals may live on private land. Therefore the ethical responsibilities for conservation of wildlife rest with the people. They can do the greatest service to their own interests and to those of Kansas by insisting that their State Conservation Department employ adequate personnel accurately to inventory the beaver population each season, employ trained research workers to study problems of management, employ articulate persons to conduct a sound educational program, and employ technically-trained persons to administer a sound management plan under which the beaver will be wisely used as one part of our renewable natural resources.

ECOLOGY

Habitat Requirements

In Kansas, most beaver live in one of two habitats. The first is streams in which the year-around flow is so much that it makes the impoundment of water by beaver dams either impossible or unnecessary (Fig. 13). In such streams, when all other habitat requirements are met, beaver tend to become more abundant per mile of stream, less concentrated and to have larger home ranges

Fig. 13. The Wakarusa River is typical of streams in eastern Kansas, having steep banks and long pools of deep water. In such streams beaver usually do not build dams. Photo taken on November 11, 1959, approximately 2 miles south and ¼ mile east of Iowa Street and 23rd Street of Lawrence, Douglas County, Kansas.

than elsewhere in Kansas. In those streams it is difficult to distinguish colonies, if such exist. For example, along the Wakarusa River in Douglas County, beaver tracks were found in each quarter mile of a ten-mile stretch of that river, from a point 5 miles west and 1½ miles south of Iowa and 23rd streets, Lawrence, to a point 2 miles due south of Iowa and 23rd streets. Most of the large rivers in eastern Kansas have beaver distributed in the fashion just described.

The second habitat is shallow streams (Fig. 14) of slight flow, like many in the western half of the state. On these, dams are essential to the beaver. In Ellis County, in 1954, beaver lived in

distinct colonies along the Smoky Hill River; any one colony was approximately two miles by stream from the next consecutive colony.

An important requirement of the beaver is a permanent supply of water, and without it, they die or migrate. If attacked by an enemy while far from water, a beaver, though not helpless, is so awkward that it is apt to be killed. For beaver permanently to inhabit a stream, water equivalent to the flow through a one-inch pipe must be present for at least ten months of the year (Stains and Baker, 1958:46).

Beaver shun areas where certain impurities are present in the water. Oil pollution in streams often cause beaver to move or die.

Fig. 14. The Cimarron River in Grant County 18 miles north and 1 mile west of Hugoton, Kansas. This type of river is typical of western Kansas. On such streams beaver usually build dams that increase the depth of water in which beaver swim and escape their enemies. Photo taken on July 23, 1959.

George Whitaker, District Warden, Atwood, Kansas, found several dead beaver in a pond where the water had become polluted with acid from fallen leaves. Also pollution by salt, sewage and certain chemicals may discourage beaver from living on a stream.

Another habitat requirement of beaver is an adequate site for constructing a lodge or burrow. In most places in Kansas beaver live in bank burrows. The stability of the soil is significant in the location of a colony. Many streams in Kansas have sandy banks and sandy stream beds and unless a beaver is able to dig a burrow

under the roots of a tree, the loose soil caves in and discourages the animal. When a dam is built, shifting sand moving downstream soon fills many ponds and the beaver are forced to relocate.

In flat, marshy areas where burrow sites are lacking, beaver usually construct lodges in which to live.

Still another requirement of beaver is an adequate food supply at the site of the colony. Willow and cottonwood constitute the main plant species used for food and for construction purposes by beaver in Kansas. Where cottonwood and willow are not found in abundance, beaver feed on other plants growing along the stream at the site of the colony.

Colony Organization and Behavior

The supposition that the beaver family consists of the parents, yearlings and kits is widely accepted by most authorities (Denney, 1952). A colony consists of one or more families. The number of individual animals per colony varies from 1 to 12 or more, depending upon conditions. In Michigan, Bradt (1947:18) found that in 57 colonies the average number of beaver per colony was 5.1. Other workers agree that five is near the average number of individuals per colony. Because of the natural tendencies of beaver to disperse, newer colonies consist of smaller numbers. An established and active colony may consist of only one individual beaver. These beaver were referred to by early trappers as "bachelor beaver." The trappers believed that the beaver mated only once and for life and if its mate were killed the remaining beaver would live by itself. This was not established and the reason for bachelor beaver remains unknown. Some solitary beaver are disabled in one way or another and may have been forced out of a colony or more likely became solitary because unmated.

The life span of the beaver is not known. Morgan (1868) guessed the life span to be between 12 and 15 years on the basis of reports of Indians and trappers. Bradt (1938:159) reported that an individual beaver was known to have lived 11 years. Age determination of beaver is difficult, especially after the animal has reached maturity. Prior to maturity, the weight of the individual beaver gives a fair indication of its age. Beaver weighing 12 pounds or less are no more than one year old, 12 to 25 pounds two years old, and 26 to 40 pounds three or more years old. After reaching maturity the rate of increase and the weight both depend to a great extent upon the individual characteristics of the animal.

Observers are almost evenly divided as to whether or not beaver are monogamous or polygamous (Denney, 1952:5). Studies indicate that all age classes of beaver have a sex ratio that is about equal. This suggests that beaver mate in pairs.

Beaver mate and have young when three years old. Breeding takes place in January and February. The period of gestation is not definitely known, but is thought to be between three and four months. The young are born in May and June. The average number of young per litter is four, but varies from one to six and rarely to seven and eight. Older females produce larger litters than younger females.

At birth a young, termed a kit, weighs one pound or slightly less. Kits have downy fur, open eyes, and are able to swim a short time after birth. According to Schwartz (1959:168), "Although they [the young] are able to swim at once, they seldom come out of the den until about 1 month old. Then they swim with their mother who often carries them on her back in the water. The female takes entire care of the kits until this time, but the male soon returns to the family. The young are weaned when about 6 weeks old and weigh 4 pounds." They remain in their parents' den for at least one year and then continue to live in the colony but inhabit a different den. Grasse and Putnam (1950) and others agree that the two-year-old young are driven from colonies containing younger animals. On this forced migration beaver do not always follow water courses. One beaver in Kansas was obtained nine miles away from a water course. The distance traveled by a migrating beaver is governed by the availability of unoccupied areas having necessary habitat and also by the availability of mates. Beaver generally disperse in late spring and early summer. Once the wandering beaver finds a suitable area and a mate, the pair establishes a new colony.

Beaver are thought to communicate by several methods. One is by slapping their tails against the water when danger is near. According to Ernest T. Seton (1937:478), beaver make several different sounds each probably having a different meaning to their kind. Castor mounds sometimes found along the banks of beaver ponds are believed to serve a communication function. The mounds are constructed of mud and small sticks, usually are dome shaped, and are four to eight inches across at the base. Onto these mounds beaver secrete castor which usually is dark red or maroon and has a strong odor. Feces ordinarily are deposited in the water.

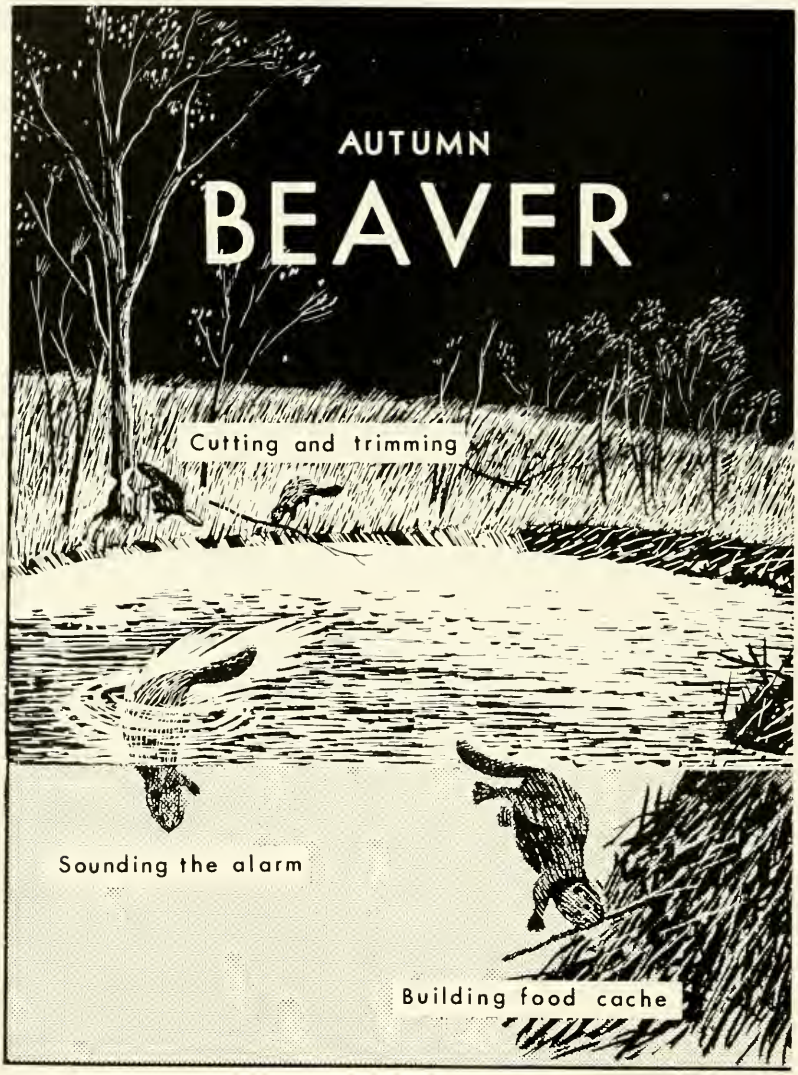
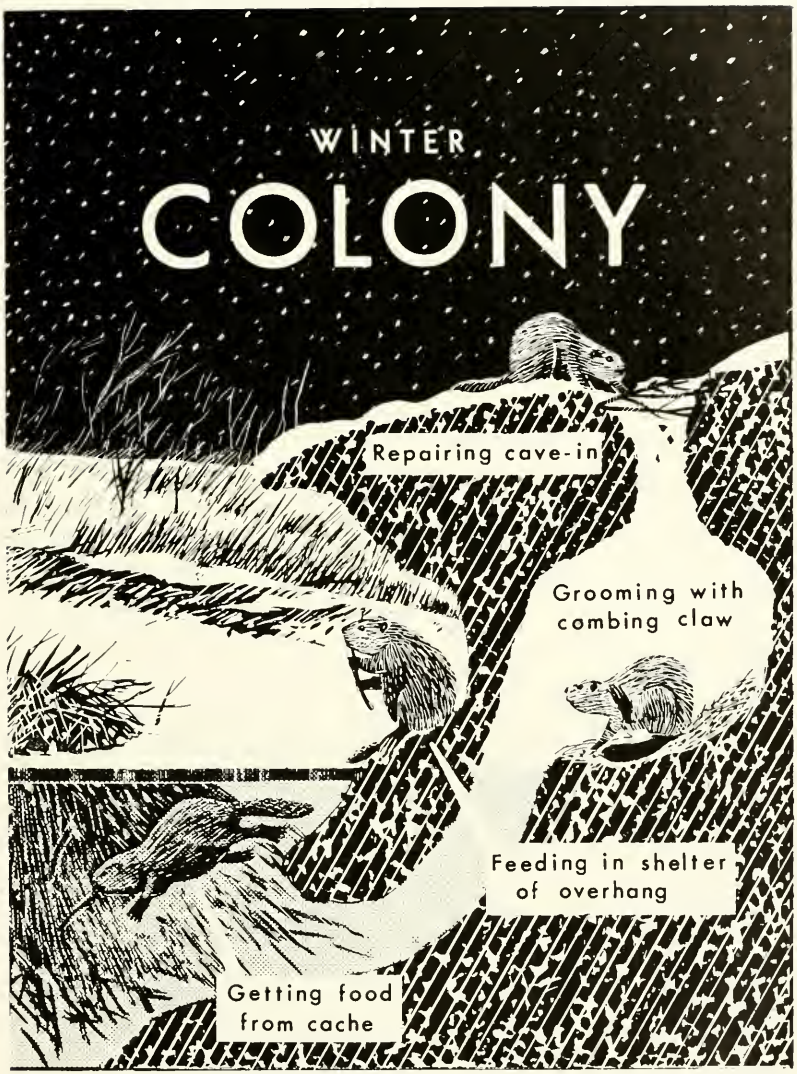


FIG. 15. Beaver work in autumn



in order to survive in winter.

After a colony is established it may have several bank burrows. One principal type of bank den has a tunnel leading from a submerged entrance up to an underground chamber (Fig. 15) located anywhere from six to fifty feet back in the bank above the water level. The tunnel varies from twelve to thirty inches in diameter. An occasional chamber is large enough to accommodate two grown men sitting upright. In winter, beaver bring food into the chamber and debris collects on the floor. The beaver enlarge the room by further excavating from the ceiling and walls especially in spring. The chamber often becomes so large that the roof caves in, leaving a large hole in the ground. When this happens the beaver occupying the den are forced to dig another chamber, but when the cave-in is not too extensive the beaver often repair the hole by covering it with limbs and plastering the cracks shut with mud (Fig. 15). Beaver continue to dig new tunnels and openings until some old bank burrows may have several adjoining tunnels each leading to a living-chamber and such dens may have many openings both at the water level and below.

Near a food cache beaver sometimes dig a feeding den, which is merely a pocket under the bank where the beaver feed in concealment.

The average number of individuals per bank den is thought to be four, but may vary according to season. With the advent of cold

Fig. 16. Typical beaver lodge. Photo taken on southeast cove of Gardner Lake in Johnson County, Kansas, in January, 1960.

weather beaver living in separate habitations often move into one centrally-located den having access to deeper water where food is usually stored. Perhaps these beaver benefit from the maintenance of higher temperature more than would be possible if fewer animals lived in the same den.

In Kansas, beaver lodges are constructed of limbs and poles of cottonwood and willow. The lodge shown in Figure 16 is typical. It was dome shaped, eight feet in diameter, and four feet high. The lodge was in a stand of willows growing in water less than one foot deep. There were three openings from the chamber which was in the center of the lodge above the water level. One entrance was at a depth of 38 inches, and the other two were just under the surface. Canals had been dug by the beaver to the deeper channel located approximately 20 feet away on the south side of the lodge.

A third type of shelter in which beaver in Kansas sometimes live is a combination of the lodge and the bank burrow. This false lodge is a dome-shaped structure built by piling limbs and poles on or against the shore of the stream. The beaver tunnels through the sticks and into the bank where the den is located. This type of false lodge may originate from the repairs of a bank burrow that has caved in. Many persons refer to this type of structure as a lodge.

By building dams, beaver impound water in ponds in streams that would otherwise normally be only a few inches deep (Fig. 17). The

Fig. 17. Typical beaver dam that created a seven-acre pond where only a small stream had flowed previously. Photo taken by George Latham on Rock Creek in Jefferson County, Kansas, in 1958.

method of construction which beaver use in building dams always appears to be the same. Branches of cottonwood and willow or whatever species of usable plant is most available are cut and placed on the bottom with the larger ends upstream. Mud and gravel, and stones if available are put against the branches. Then other layers of brush are placed upon the first, each in turn weighed down by mud and gravel until the dam reaches the desired height. Most beaver dams found in Kansas are less than four feet high.

At first the water leaks through the loosely-constructed dam, but as the current brings down sediment and the beaver bring up more

Fig. 18. Beaver sometimes use material other than cottonwood and willow to build dams. Here on Buck Creek in Jefferson County, Kansas, beaver built this dam out of cornstalks and stones. Picture taken by Leonard Bacon, September 28, 1959.

mud from the stream bed and place the mud on the upper side and crest, the dam soon begins to hold water and the pond fills. The dam is kept in constant repair by the beaver. Old dams can sometimes be found with willow trees and other vegetation growing on the top and downstream side.

Dams consisting wholly of mud or aquatic plants are sometimes found in Kansas; these dams usually are in habitats where other suitable building material is not abundant. The beaver dam shown in Fig. 18 is constructed of corn stalks and stones. Occasionally beaver use a fallen tree or piles of drift as a site for a dam. Beaver

dams vary in length depending upon the site. Most dams are less than 50 feet across, but other dams have been found that are several hundred feet in length (Fig. 19).

Some dams are built straight across a stream, but others curve up or down stream and still others are built in a wavy line across a stream. There are stories extolling the excellent judgment of beaver in building and locating dams. Nevertheless, many dams wash out before completion or fail to impound the required amount of water. The curvature of the dam is often caused by the swiftness of the water as it passes through the gap prior to the completion.

Fig. 19. Beaver sometimes build secondary dams (one shown here) connected to the major dam (out of sight to the right). These secondary dams often extend for several hundred feet and are seldom more than two feet high. Photo by George Latham on Rock Creek in Jefferson County, Kansas, in 1958.

A colony of beaver may build several dams depending upon their needs. Dams and ponds are abandoned usually because the food supply becomes exhausted. The time lapse before beaver occupy the same area again depends upon the growth of a new food supply.

Warren (1927:46) found instances in which beaver drained the water from their ponds. One opinion expressed is that such draining served sanitary purposes permitting the air and sun to purify the bottom of the ponds.

From October to December members of a colony engage in a combined effort to cut and store food for the winter. They cut trees

that are usually less than six inches in diameter that often fall in the direction of the stream as if planned that way by the animals. This is probably because most trees naturally lean downhill toward the water, and therefore fall that way. Wind may influence the direction in which the trees fall. Trees sometimes wedge against one another and are left as waste although a wedge tree is often saved by cutting the adjacent tree. Beaver have been found trapped or killed by trees that they had cut.

To fell a tree, the beaver stands on its hind legs and grips the bark with the sharp curved nails on its front feet. It spreads its

Fig. 20. A typical food cache of willow and cottonwood stored by beaver for their winter food supply. Photo on the Saline River, Ellis County, Kansas, November 25, 1959.

hind feet wide and braces itself with its tail. While the front teeth drive into the wood like a holding fork, the lower teeth cut a deep notch about three inches below. Then the beaver tears out the chunk of wood between (after Platt, 1957:52).

Beaver generally cut through a tree by working on one side. A single beaver generally works on one tree, but it does not always work on the same tree that it started on and it may cut nearly through a tree and then abandon it.

After a tree is felled the branches are cut into suitable lengths for transportation to the storage pile (Fig. 20). The food is stored from

four to ten feet beneath the surface of the water near the shore and den entrance. The beaver forces the first layer into the bottom and entangles the other layers with the first. The green wood being heavy tends to stay in place.

Beaver dig canals when necessary. The water in the canal makes the beaver safer from enemies than would be the case if the water were shallow. Such canals are used for transporting food in periods of drought and to drain water from one area to another. Canals vary in depth depending upon the situation. Canals are dug deeper when ice covers them. A canal approximately 15 feet long and 5 feet wide, 2 miles west of Pittsburg, Crawford County, Kansas, was dug by beaver and is used by them in traveling between two old strip-mine lakes resulting from coal mining operations (according to Charles A. Long, November, 1959).

In dragging limbs into the water, beaver often make deep paths. Once in the water the food is floated and held by means of the teeth as the animal swims to the food cache.

The size of the food cache varies with the number of individuals in the colony and the amount of food available. During warm spells in winter when their pond is free from ice, the beaver often venture onto the bank and cut trees. When ice covers the pond the beaver spend most of the time in the dry chambers of their dens and their activity in general is greatly reduced. According to Schwartz (1959:167), beaver swim about 2 miles an hour and have been observed to swim continuously under water for ½ mile; they have large lungs that hold a supply of air and an enlarged liver that stores enough oxygenated blood to permit the beaver to stay under water for 15 minutes at a time; in winter, beaver swim under the ice, obtaining oxygen from air holes or from air trapped in pockets between the ice and water. According to my own observations, after all the food in a den is eaten a beaver swims out to the stored food and brings some of it back to the den (Fig. 15). If the water of a beaver pond is clear a person can often find dens in which beaver are living by watching for the discarded limbs in front of the entrances. These limbs are light yellow having had the bark recently stripped from them.

Beaver apparently do not always store food in the form of a cache as described. Sometimes they store great quantities of food underground, an example of which was found by Tom Swearingen in the winter of 1956 when he was trapping along the Grasshopper River in Atchison County, Kansas. As he walked along the bank he fell

through the roof of a beaver burrow and found a great quantity of ears of corn and corn stalks stored in a chamber.

Beaver in some instances store no food and rely on food that they obtain as needed from the shore. Feeding in this fashion may be more common than elsewhere in the extreme southeastern parts of the state where the normal winter temperatures remain high enough to permit a stream to maintain an ice-free flow all year long.

Cottonwood and willow are the preferred foods of the beaver, but in addition the following plants have been found cut and the

Fig. 21. When beaver begin to use up all the suitable food in an area they sometimes gnaw on large trees. Shown here are several large cottonwood trees that were flooded and ringed by beaver. Photo taken 6.3 miles west of Cunningham, Pratt County, Kansas, in early spring of 1955 by Guido Smith.

bark eaten: Elm (Red, American and Chinese), Green Ash, Hackberry, Maple, Mulberry, Box Elder and Sycamore. Beaver occasionally cut Hickory, Oak, Dogwood, Locust, Buttonbush, and Salt Cedar, but these seemingly do not constitute an important source of food.

In spring and summer beaver seem to depend less upon bark for food and utilize aquatic plants and the tender green shoots of terrestial plants. Plants of this kind found cut by beaver are as follows: Ragweed, Pigweed, Sunflower, Smartweed, Cattail, Bulrushes, Sedges, Corn, Maize and others found growing near the water's edge. Cornfields bordering beaver colonies often have well-worn

trails over which the beaver drag the corn stalks into the water. Non-woody vegetation is estimated to constitute three-fifths of the beaver's annual food.

Large trees as shown in Fig. 21 are sometimes gnawed on by beaver in summer. The beaver did not seem to lack food in all areas where such instances were recorded. Gnawing wears away the ends of the evergrowing incisor teeth that otherwise would grow so long as to cut into the lower jaw, block the mouth, and cause the beaver to starve. Injury to the mouth or jaw of an occasional beaver prevents his gnawing for a time and probably accounts

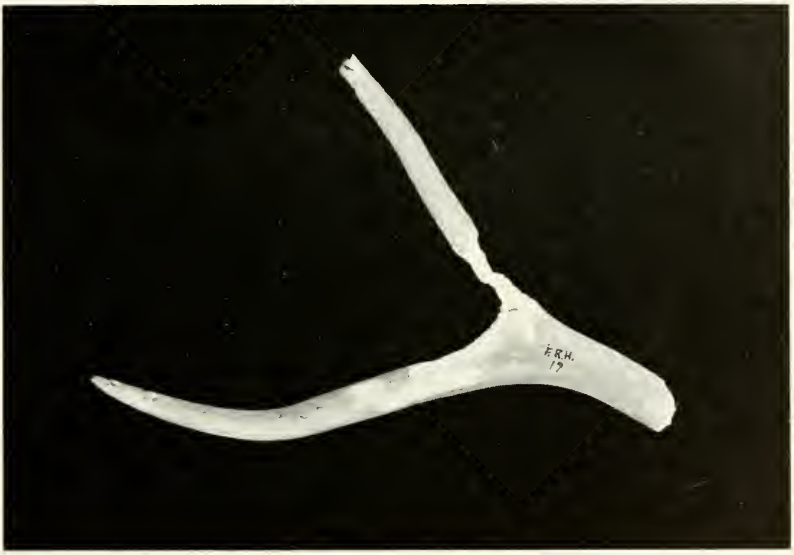


Fig. 22. This deer antler was found inside a tunnel leading to a beaver's den. Microscopic examination of the tooth marks on the antler indicated that a small rodent had gnawed the antler nearly in two. The antler was found on January 9, 1960, along Mud Creek approximately 1 mile north of Midland in Douglas County, Kansas.

for overgrown incisors found in dead beaver in nature (see Honess and Winter, 1956).

Bradt (1947:33) found that in Michigan one beaver would cut 216 aspen trees per year. He calculated that one acre of aspen could support an average colony of beaver from one year to two and one-half years, depending upon circumstances. Cottonwood belonging to the same genus as the aspen should have comparable food value, depending upon the type of soil in which it is growing. Bailey (1927:33) found that an aspen one inch in diameter provided enough food for a captive beaver for one night.

Beaver often are accused of eating fish, especially when remains of fish are found at the site of a beaver colony. No proof of beaver eating fish has been recorded in Kansas. Circumstantial evidence that beavers do so can usually be traced to mink, raccoon or other carnivorous animals that inhabit the same areas as beaver. In January, 1960, a deer antler (Fig. 22), gnawed almost in two, was found in a beaver den. Antlers of deer often are eaten by small rodents; the calcium content of antlers is high.

Evaluation of a habitat for beaver should be based upon the supply of suitable food within 200 feet of deep water—the nearer to the water, the better. Danger of predation increases with distance the beaver has to travel to obtain food. Beaver tend to utilize small trees more completely than larger trees and those with smooth bark are eaten more completely than those with rough bark.

Once established a beaver colony remains in a given area as long as the colony is undisturbed and as long as the food supply lasts. When the food supply is almost exhausted beaver gnaw on large trees and even chew on dead trees felled previously. Eventually the beaver either migrate to a more suitable area or die of disease possibly resulting from malnutrition. Willow and cottonwood (Figs. 23, 24) are fast-growing plants, and sprouts from cut stumps, plus new plants, may furnish enough food to support a colony for a period of seven to ten years after the last of the plants are cut that were present when the beaver first took up residence there.

Climate in Kansas seems not to be a critical factor in the life of the beaver providing all other requirements of a suitable habitat are present. Nevertheless, weather extremes can adversely affect local populations of beaver and may reduce their numbers. Drought tends to crowd beaver and therefore causes hardship. Floods occurring in late spring and early summer often cause bank dens to cave in and kill the young occupants. Floods in late autumn can wash food caches downstream and may create a food shortage for beaver in winter.

The late Dr. L. D. Wooster prepared the data in Table 4 on annual rainfall at Hays, Ellis County, Kansas, for the years 1868 through 1959. As shown, droughts in Kansas generally last an average of 5½ years, followed by a mixed period which lasts for an average of 11 years and then a 5½ year period of above average precipitation, followed by another drought period. Such known weather cycles make long-range planning possible in game management, including regulation of number of colonies of beaver.

Fig. 23. Not all trees cut down by beaver are killed. Cottonwood often send up new shoots. Photo on November 27, 1959, ¾ mile east of Cedar Bluffs Reservoir Dam, Trego County, Kansas.

Fig. 24. Dead stump of cottonwood cut by beaver is shown at left. The stump at right lived and sent up new shoots that later were used by beaver for food. Photo on November 27, 1959, ¾ mile east of Cedar Bluffs Reservoir Dam, Trego County, Kansas.

Table 4.—Precipitation Records at Hays, Kansas, From 1868 to 1959, Inclusive (After Wooster, 1959).

Average Annual Rainfall—about 23 inches

Years	Annual rainfall		Average in inches
1844	.....	Floods	
1867	.....	Floods	
1868	15.52	6 yrs. Drouth Period	19.28
1869	20.32		
1870	19.79		
1871	23.00		
1872	16.36		
1873	20.68		
1874	26.88	11 yrs. Mixed Period	24.73
1875	32.08		
1876	28.64		
1877	35.40		
1879	20.62		
1880	20.88		
1881	20.88		
1882	15.27		
1883	21.14		
1884	20.04		
1885	25.95	5 yrs. Wet Period (Floods)	24.91
1886	28.74		
1887	22.33		
1888	20.18		
1889	27.36		
1890	15.17	6 yrs. Drouth Period (Dust Storm)	17.42
1891	24.21		
1892	22.53		
1893	18.16		
1894	11.60		
1895	12.64		
1896	27.70	9 yrs. Mixed Period (Floods)	26.83
1897	26.73		
1898	31.55		
1899	21.68		
1900	26.38		
1901	22.85		
1902	34.65		
1903	32.52		
1904	17.45		
1905	23.73	5 yrs. (Floods) Wet Period	25.16
1906	23.08		
1907	25.40		
1908	25.33		
1909	28.27		
1910	16.17	5 yrs. Drouth Period (Crop Failures)	18.65
1911	17.15		
1912	20.20		
1913	23.10		
1914	16.63		
1915	34.14	12 yrs. Mixed Period	21.38
1916	16.01		
1917	16.92		
1918	23.58		
1919	26.13		
1920	21.28		
1921	18.46		
1922	18.98		
1923	27.10		
1924	14.51		
1925	23.02		
1926	16.45		
1927	27.21	(Floods) 6 yrs. Wet Period	27.74
1928	29.94		
1929	26.57		
1930	25.03		
1931	26.06		
1932	31.66		
1933	16.26	5 yrs. Drouth Period (Dust Storms)	17.29
1934	16.06		
1935	21.87		
1936	15.90		
1937	17.86		
1938	22.11	8 yrs. Mixed Period	23.11
1939	15.85		
1940	22.91		
1941	28.13		
1942	29.61		
1943	16.19		
1944	29.70		
1945	20.34		
1946	26.48	6 yrs. Wet Period (Floods)	27.97
1947	22.65		
1948	26.19		
1949	23.62		
1950	25.59		
1951	43.34		
1952	13.39	5 yrs. Drouth Period	16.65
1953	21.07		
1954	18.44		
1955	21.16		
1956	9.21		
1957	28.33	Wet Period	27.99
1958	31.21		
1959	24.43[1]		

1. From G. W. Tomanek, *in litt.*

The beaver often creates favorable conditions for many other kinds of animals that, with few exceptions, live harmoniously within the beaver's realm. The muskrat is nearly always found living within or close to beaver colonies. The habits of the two animals are similiar yet they appear to live in the same area without conflict. Colonies of beaver often are situated close to dwellings of man, or are near places frequented by him and unless molested the beaver remain. In fact, some Kansas landowners have found it difficult to discourage beaver by intensively molesting them and by destroying the dams built by beaver.

Mortality Factors

Occasionally Game Protectors report a beaver die-off in their districts, but the causes of death of the beaver in such cases in Kansas have never been determined, or at least recorded. In other states beaver have been found to die from tularemia and rabies. Probably other diseases kill beaver. Kansas needs a pathology laboratory where diseases of wildlife could be recorded and studied.

Predators account for some beaver mortality. Coyotes have been known to prey on beaver. Bobcats are found in some parts of Kansas and remains of beaver have been found in the stomachs of bobcats in other states. Mink are found in the same areas as beaver, and Swank, according to Denney (1952:8), presumably in West Virginia, found evidence of mink killing beaver. Domestic dogs wandering along streams often kill beaver. However, beaver mortality due to predation is probably of slight importance as a controlling factor to the over-all population of beaver. Destruction of habitat, man's influence otherwise, and extremes of the climate are more important factors.

Parasites would be considered in a thorough study of mortality factors. Of the ectoparasites, no fleas were found by me. Beaver normally have small beetles, *Platypsylla castoris*, living in the fur.

TRAPPING AND PELTING

Knowledge of Habits—Traps and Equipment

Trapping beaver requires a great deal of physical labor as well as thorough and intimate knowledge of the animal's habits. Skill in trapping and in preparing the pelt is acquired slowly and experience is the best teacher. The beaver is one of the most difficult furbearers to skin. The techniques described beyond should serve as a basic guide for the amateur beaver trapper.

Having studied the life history and ecology of beaver, a trapper should then familiarize himself with the state laws pertaining to

beaver trapping. The season for trapping beaver in Kansas is set each year in late August or early September by the Kansas Forestry, Fish and Game Commission. Each person having a trapper's license is entitled to 20 traps, which must be attended or visited each day. Dens, lodges and dams of beaver must not be destroyed.

In order to be sure that he will be welcome on the land where he wishes to trap, the trapper should obtain permission from the owner of the land before entering thereon. He should respect the privilege which the landowner grants, by shutting gates, by not driving over fields that might be damaged, and above all by restricting the use of firearms to his actual needs in connection with trapping. Observation of these rules will go far to make the beaver trapper welcome in another year.

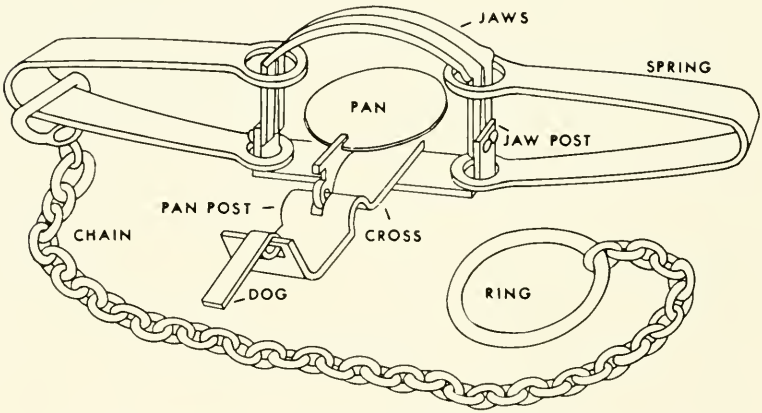


Fig. 25. Diagram of a double-spring steel trap and its main parts. × approximately ⅕.

The trap (Fig. 25) is the basic item needed to catch beaver. Traps should be large enough to catch beaver high on the leg and thus decrease the chance of "wring-offs." Traps that can be used for beaver trapping include Numbers 48, 44, 14 and 4½. Number 14 is ideal. Beaver are caught in numbers three and four coyote traps by many Kansas trappers but the chances of misses or wring-offs are so great with these traps that it does not pay to use them. Traps should have about four feet of chain and a trapper should have five to eight feet of number nine wire per trap in case it is needed. New traps can be purchased from mail-order houses or jobbers in trapping supplies at prices ranging from $14.95 each for the Number 4½ trap to the more popular Number 14 Jump trap that sells for $5.00 each.

A new type of trap, the "Conibear," developed by Frank Conibear, is manufactured by a well-known trap manufacturer and has been on the market a short time. Number 330 is designed to take beaver and is reported to work well in runway sets and den sets. This trap was designed as a more humane type than are most other types of traps used for catching furbearers. The Conibear trap kills the animal quickly. That trap has to be set differently than other traps and for that reason experienced trappers are reluctant to change from traps with which they are familiar, but the Conibear trap probably will gain acceptance and use in time.

In addition to traps, the equipment of a beaver trapper should include an axe for cutting and driving stakes, hip boots, and a .22 cal. pistol. Scent can be of great advantage to the trapper. The basic ingredients are ground castor glands. These glands are located at the base of the tail as shown in Fig. 26. They contain

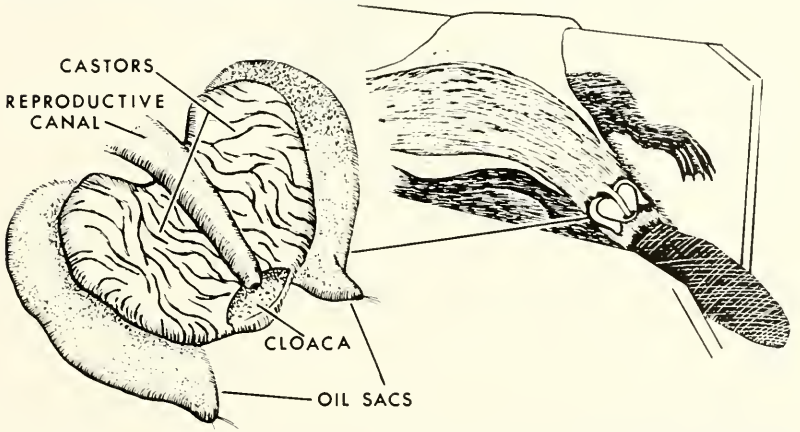


Fig. 26. Showing location of castor glands, oil sacs, reproductive canal and cloaca.

castoreum, which has a commercial value as a perfume base. The glands not used by the trapper should be stored to dry and later sold with the pelts.

Trapping

The "trap shy" or three-legged beaver is infinitely wiser than one which is not aware of the danger of a steel trap. Whenever possible the trap should be set so that the captured animal will drown quickly. One of the most important considerations is to set the trap off center in the path that the beaver is expected to take, because the beaver while walking or swimming places its feet on the

outer edge of the path and if the trap is set in the center of the trail, the beaver might spring the trap without getting caught or the trap might grip insecurely permitting him to twist his leg free from the trap.

Beaver tracks (see Fig. 27) have a characteristic shape but many are slightly modified by the impressions of a beaver tail that has been dragged across the tracks.

The trapper should remember when setting a trap that it is better to catch a beaver by the hind foot than by the front foot. Wring-offs are less likely if the trap catches a hind foot. The trapper should not set too many traps. Two or three carefully-

Fig. 27. Tracks of beaver. Front foot (f) Hind foot (h). Vertical line at right represents one inch. Tracks of the hind feet of large beaver are more than 4 inches long. The impression of the tail is wide and in a fairly straight line. Marks of the hind toes point inward as shown in the lower part of the figure.

placed traps will catch as many or more beaver than a dozen traps scattered about haphazardly.

Several methods of placing traps have merit. Three proven methods for catching beaver in steel traps in Kansas are explained beyond. One is to place traps in runways, canals, feeding areas, slides, trails or other places where beaver naturally travel (Fig. 28). In any of these areas the trap should be placed under water on a solid footing, with the jaws of the trap parallel to the line of travel. If long-spring traps are used the springs or "ears" should be placed at an angle to the jaws. The trap should be 6 to 8 inches out from the bank where the beaver will swim over it and hit the pan with one of his hind feet as he places his front feet on the bank. Once in place the trap should be covered with water-soaked

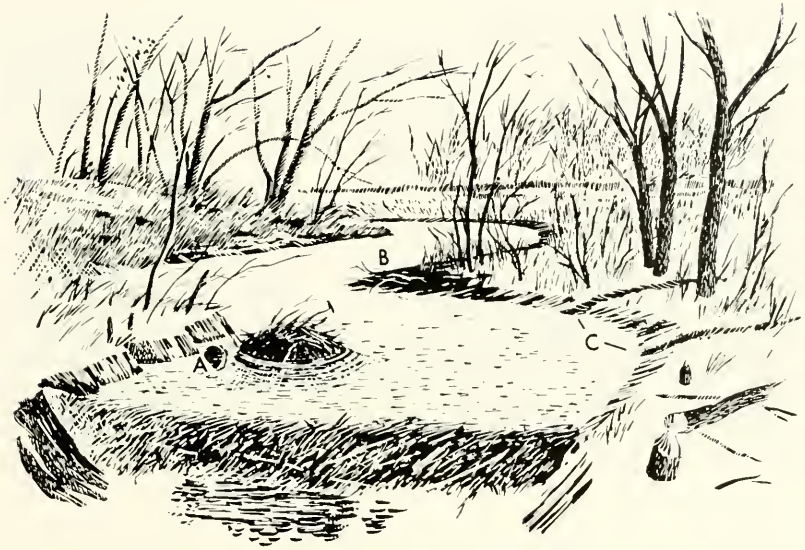


Fig. 28. Traps are generally set in dens (A), feeding areas along the shore line (B), or in trails that lead from the water to the logging areas (C).

leaves; all sizable debris floating nearby should be removed from the water.

A stake three to four inches in diameter should be driven securely into the stream bed, a short distance from the bank in water at least three feet deep. After the trap is in place a strand of number nine wire should be attached to the ring of the trap chain and to the stake. As soon as the animal is caught, it usually dives for deep water and in most instances the weight of the trap pulls the beaver under and quickly drowns it. If traps of light weight are used, an additional weight of ten to fifteen pounds should be attached to the trap to insure drowning.

If conditions at the trap site make it impossible to drown the animal, the trap should be visited more frequently. A shot from a .22 pistol in the ear or the top of the head will quickly dispatch the animal with a minimum of damage to the pelt.

A combination of scent and bait used at the above type of set often proves effective. A fresh green limb cut from a cottonwood should be stuck in the bank above the trap (see Fig. 29). Peal the bark back three to four inches with a knife, then rub the castor gland over the pealed portion of the stick. The first beaver that

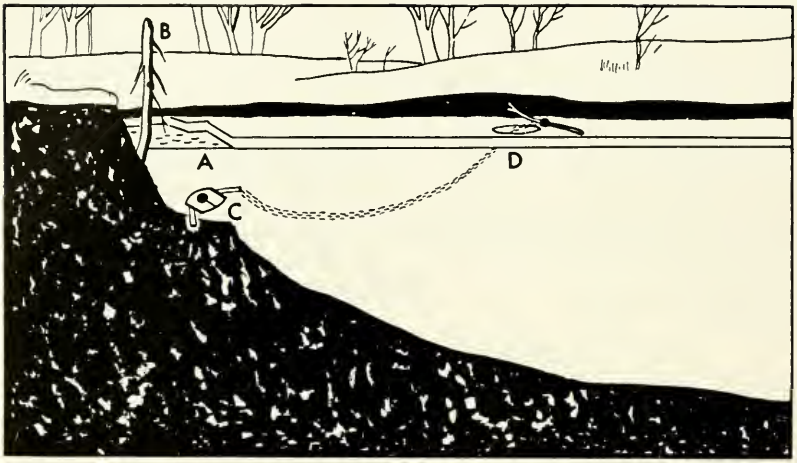


Fig. 29. One of the most popular trap-sets used in Kansas for taking beaver is shown in this drawing. Beaver generally keep the ice open in a small area (A) near shore. Beaver break the ice from the underside by striking their heads against it. When such a place is found a green limb (B) from the upper branches of a young cottonwood tree should be placed just above the water level, and scent is sometimes placed on the limb to attract the beaver. The trap (C) is placed on a shelf about 2 feet below the water surface and is secured to a holding pole (D).

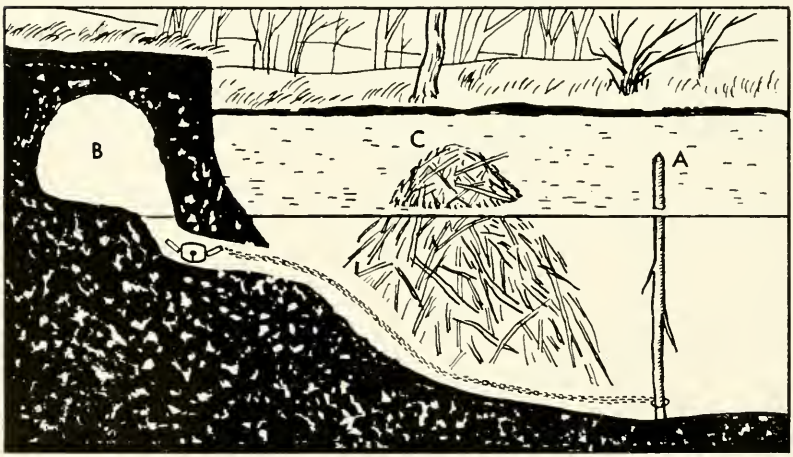


Fig. 30. Underwater view showing trap stake (A) in deep water, (B) position of trap in relation to tunnel and den, and food cache (C).

swims nearby likely will be attracted to the bait and get caught in the trap.

The second method often used by Kansas beaver trappers is referred to as a den set. The trap should be placed three to four

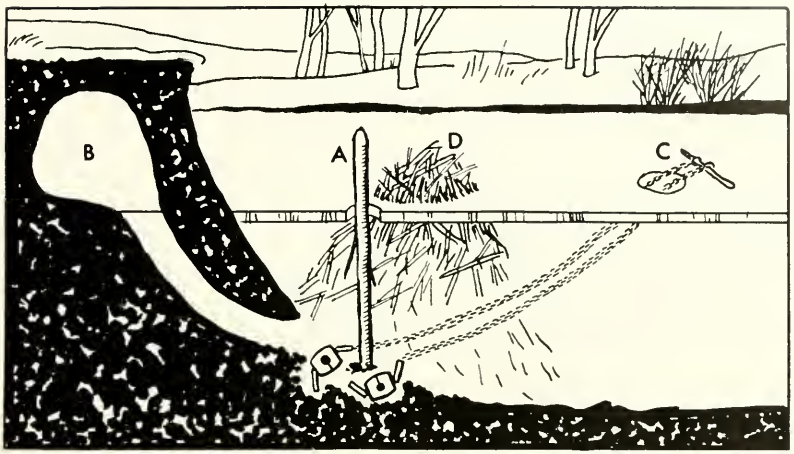


FIG. 31. Traps set under ice. (A) Fresh cottonwood log 6" in diameter used as bait. (B) Den. (C) Holding pole. (D) Food cache.

inches under water where the beaver leaves the water in order to enter the living chamber. This particular set is the one most likely to catch beaver, but to place the trap in the proper position often entails hardship for the trapper. If the burrow leading to the living chamber is in such a position as to prevent the trapper from placing the trap as in Fig. 30, the trap should be placed at the entrance of the den. If the entrance is in deep water the trap can be lowered into position on a forked stick or pole. To ensure that a trap is in the proper place, two traps are sometimes used.

In late winter, when the beaver's pelt is at the peak of primeness and of maximum value, streams and rivers often are covered with ice. Then a third method, to catch beaver under the ice, is usually used. First chop a hole about a foot and one-half in diameter through the ice, preferably between the den and the food cache. Then select a green cottonwood pole five to six inches in diameter and several feet long. It should be driven into the stream bed nearly vertically. Two traps should be used. By means of wire attached to the trap rings, lower the traps so that one rests on each side of the base of the pole. Run the other end of each wire under the ice and through another hole and attach the wire to a small pole as shown in Fig. 31. When feeding on the fresh cottonwood bark a beaver will almost certainly step into one or both of the traps, will be caught, and will then drown.

Pelting

Beaver can be skinned almost anywhere; if a large beaver is caught at a distance from a road, it is usually easiest to skin the animal on the spot rather than carry it back. If the beaver is

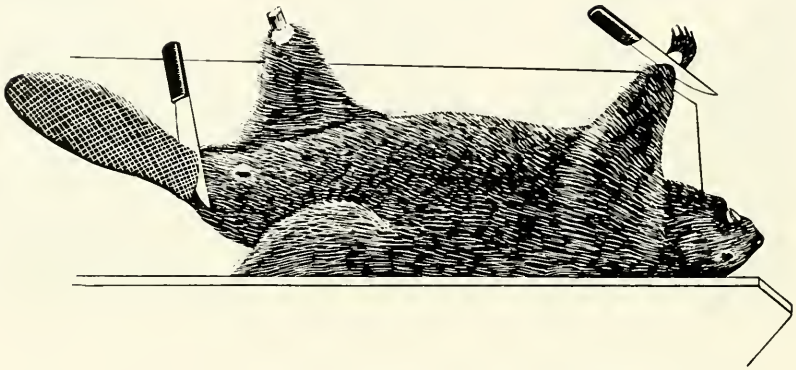


Fig. 32. The first step in skinning a beaver is to remove the tail and feet. × 1/10.

brought in, the work of skinning can be greatly reduced if a trough of comfortable height is constructed as shown in Fig. 34 (Hay and Rutherford, 1956:10).

Experienced trappers usually use a minimum of two knives in

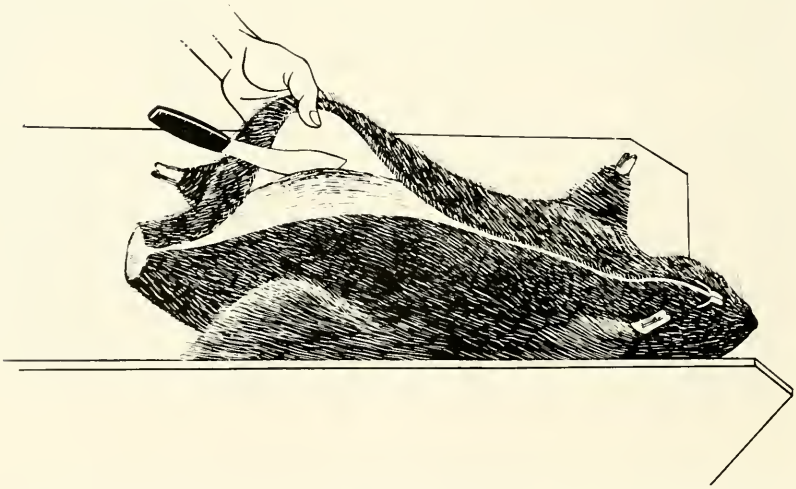


Fig. 33. The second step in skinning a beaver is to shave the pelt from the body leaving as little fat as possible on the pelt. × 1/10.

the skinning process including one five- to six-inch hide-knife and a smaller narrow-bladed knife for splitting the skin along the belly. A hand axe can be used for removing the feet and tail. A sharpening steel and a carborundum stone are aids in keeping the knives dressed. The importance of keeping skinning knives sharp cannot be overemphasized.

The pelt of a beaver cannot be pulled off; every square inch must be separated from the carcass by means of a knife, because of an intervening layer of tough fat adhering to both flesh and skin. Unskilled individuals leave fat and flesh on the pelt and such pelts are graded down by the fur buyer.

Fig. 34. Shown here is the equipment necessary to trap and skin beaver, and properly to stretch their pelts. Equipment includes skinning trough, trap, wire, hammer, hatchet, comb, pliers, knives, sharpening steel, carborundum stone, oil, nails, and stretching board.

The beaver is skinned "open" rather than "cased" as are most other furbearers, for example, muskrat, mink, and skunk. The first step in the skinning process is to cut off all four feet at the first joint and then cut off the tail as shown in Fig. 32. Then cut the skin longitudinally from the tail along the abdomen to the mouth.

Next begin "shaving" the skin from the carcass Fig. 33. The pelt must be constantly gripped and pulled taut while the knife is being applied. The most difficult areas are those around the legs, eyes and ears. The beaver should be skinned to the middle of the back and then turned over and worked on from the other side.

Stretching

Boards for stretching the skins should be 38 to 50 inches square and constructed of relatively knot-free lumber. Circular rings (Fig. 34) of different colors can be inscribed about an inch apart on the boards to serve as guides for stretching any given pelt in the proper circular shape. A claw hammer and a supply of six- or eight-penny box nails should be used to stretch the pelts for drying.

Fig. 35 shows the stages of stretching the pelt. After the size of the pelt has been determined, start the nails as shown. The nose, lips and flaps around the tail are pegged out beyond the ring. Then nail the skin to the board. The stretched pelt should have nails about one inch apart and should not be stretched drum tight, because that would make it appear to be lightly furred. Conversely a pelt that is so loosely spread as to move around on the board and be flabby is too loose. If a pelt is either too loose or too taut it is best to pull the nails and reset them as necessary to increase or decrease tension on the pelt. After the pelt is stretched, the hind-leg holes can be nailed shut and the nose, lips, and tail flaps, which were pegged out, can be trimmed off.

Stretched pelts should be stored for drying in a shady place having plenty of air circulation. They should never be dried in the sun. When the areas around the legs and ears feel dry and hard, the pelt can be removed from the board. The fur should be brushed to remove dirt and loose fur. When the pelts are stored after being removed from the boards, it is a good idea to lay a stretching board on top of the stack to prevent the edges of the hides from curling. The pelts should be stacked with the furred sides together or the skinned sides together; the skin side

of one pelt should not be stacked against the fur side of another.

A list of Kansas fur dealers can be obtained by writing to the Kansas Forestry, Fish and Game Commission at Pratt, Kansas.

Beaver pelts are classified according to grade and size when sold on the New York market, and local fur buyers can well follow the same system.

Grade (quality) refers to condition of pelt, namely to degree of primeness, presence or absence of cuts, symmetry of stretched pelt, etc. Grades are No. 1 and No. 2 and "variously damaged."

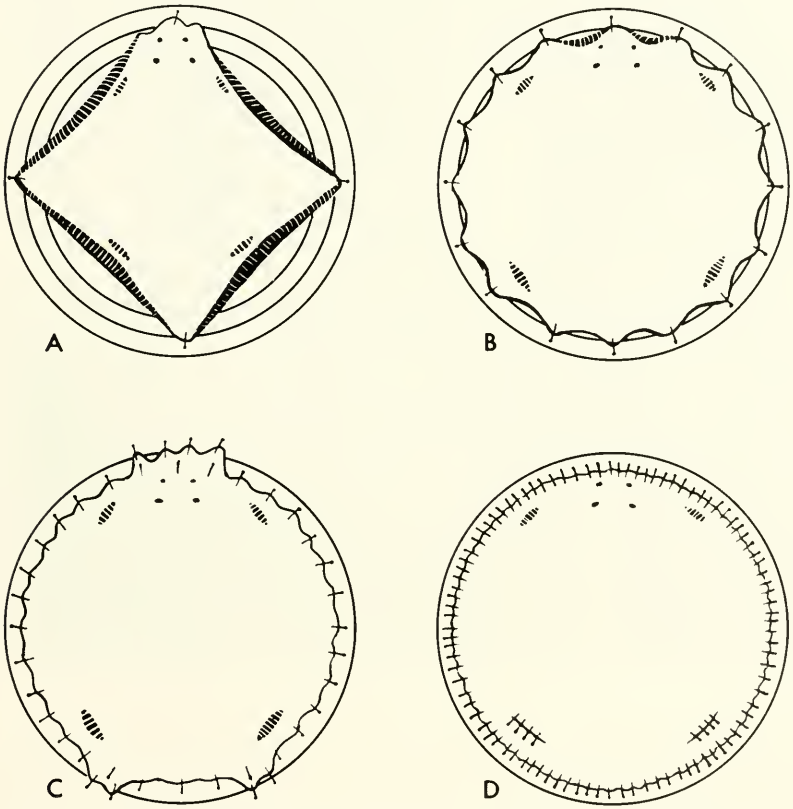


Fig. 35. The first step in nailing a pelt is to determine the size that the skin will be when stretched. Start nails as shown in A. In the second step (B) nails are placed about six inches apart around the entire skin on the selected ring. Excess skin around the nose, lips and base of tail is pulled out beyond the ring and nailed as shown in C. In the final step (D) nails are placed an inch apart and the hind-leg holes have been nailed shut.

FIG. 36. Measuring a beaver pelt (from Stains and Baker, 1958: Pl. 2).

Size (in inches) is determined by adding the length and width of a pelt (see Fig. 36). Sizes are as follows:

Superblanket	70 inches and more
Blanket	65-70 inches
Extra large	60-65 inches
Large	55-60 inches
Large medium	50-55 inches
Medium	45-50 inches
Small	45 inches and less

An "average lot" of pelts consists of approximately 12 per cent of Superblanket and Blanket, 20 per cent Extra large, 25 per cent Large, 18 per cent Large medium, 15 per cent Medium, and 10 per cent Small. Prices (see Table 3 on page 26) commonly are figured on the basis of blanket size of No. 1 grade; superblankets are more; smaller sizes are less. For pelts of the same grade, an "average lot" sells for about a fourth less per pelt than the blanket size.

RECIPES

The meat of the beaver was relished by early fur trappers and settlers. The tail, resembling fat pork in taste, was considered a delicacy by the American Indians.

In preparing the beaver, remove as much fat as possible from the carcass before cooking as both the flavor and odor of the fat are objectionable. Swank (1949:59-60) gives several recipes for preparing beaver as follows:

Fried Beaver

Remove fat and cut beaver into pieces as you would fowl. Soak overnight in cold water, drain. Cook until tender in a pot with a small amount of water and a piece of bacon. Season and brown in bacon or cooking fat. This is recommended for small animals only. Wild rice, grapefruit salad and watercress with oil and vinegar dressing add a proper touch to the meal.

Atlanta Special

Remove nearly all the fat from the beaver. Cut up as you do rabbit. Soak overnight in salt water. Parboil until about half cooked with one bay leaf, two medium onions, and garlic. Celery leaves can be added or not. Drain, roll in flour, and brown in hot fat; season with salt and pepper. Bake in covered pan in a moderate oven until tender. Gravy can be made from the drippings.

Alf Robinson, well-known Kansas conservationist, contributed the following recipe:

Robinson's Roast Beaver

Remove all surface fat from beaver. Cover meat with a weak solution of soda and water (1 teaspoon soda to 1 quart water). Parboil for about ten minutes. Drain, and stuff chest cavity with dressing, cover with sliced onions, strips of bacon and roast in moderately hot oven until well done.

CONCLUSIONS AND RECOMMENDATIONS

In most places beaver benefit man and should be encouraged in suitable habitat. In a few places the activities of beaver interfere with some of man's undertakings, and there the beaver can be reduced in number or removed. Because beaver in general are a valuable natural resource (pages 25-28), it is recommended that:

(1) The state be divided into beaver management areas (see pages 31-33 and Fig. 12).

(2) The landowner, or his agent, and an employee of the Forestry, Fish and Game Department in autumn estimate the number of beaver appropriate to trap in the succeeding late winter and early spring.

(3) If the landowner, or his agent, elects to harvest the beaver himself he should be licensed to catch the number agreed on and to retain all of the proceeds.

(4) If the landowner or his agent requests that someone else harvest the number agreed on, an employee of the Forestry, Fish and Game Department should do so on a 50-50 share-crop basis as between the Department and the landowner, in years when prices of beaver warrant departmental participation.

(5) In years when the prices of beaver and/or their pelts are so low as to make harvesting them unattractive, a few Demonstration Trappers employed by the State Department can demonstrate effective trapping techniques to those landowners and/or their tenants who need to remove beaver, so that they, under permit, can remove the beaver except as the Department may choose to catch them for transplanting.

Table 5.—Kansas Streams Arranged by Counties (after Schoewe, 1951). An Asterisk (*) Indicates Presence of Beaver on Streams. In Several of Those Counties Beaver May Be Present on Other Streams.

ALLEN COUNTY

Big
Canville
Coal
Deep
Elm
Elm
Goose
Indiana
Little Canville
*Marmaton River
*Neosho River
Owl
Rock
Scatter
Sutton
Turkey Branch Big
Vegetarian

ANDERSON COUNTY

*Big Sugar
Cedar
Crystal
Fish
Iantha
Kenoma
Mud
North Fork Pottawatomie
*Pottawatomie
Sac
South Fork Pottawatomie
Thomas

ATCHISON COUNTY

*Big Stranger
Coal
Coal
Crooked
Deer
*Delaware River
*Grasshopper
Independence
Lang Hollow
Little Delaware
Little Walnut
[*Missouri River]
Owl
Spring
Spring
Stranger
Walnut
Whiskey

BARBER COUNTY

Amber
Antelope
Ash
Bear
Big Mule
*Big Sandy
Bitter
*Cedar
Crooked
Dog
Driftwood
Dry
Elm
Hackberry
Inman
Little Bear
Little Driftwood
Little Mule
Little Sandy
*Medicine Lodge River
Salt Fork
Sand
Sand
Turkey
Walnut

BARTON COUNTY

Antelope
*Arkansas River
Blood
Booth
Cheyenne
Coal
Coal
Cow
Deception
Dry Walnut
Landon
Little Walnut
Seller
Walnut
Walnut
Wright

BOURBON COUNTY

Buck
Buck Run
Cox
Elk
Indian
*Little Osage River
Little Pawnee
Lost
*Marmaton River
Mill
Owl
Owl
Paint
Pawnee
Prong
Richland
Rock
Schubar
*South Fork Marmaton River
Tennyson
Walnut
West Fork Dry Wood
Wolverine

BROWN COUNTY

Cedar
*Craig
*Delaware
East Mission
Gregg
Laus, Lause
Little Delaware
Locklane
Middle Fork Wolf
Mission
Mulberry
Nohart
North Fork Wolf
Plum
Pony
Roys
South Fork Wolf
South Walnut
Spring
Spring
Squaw
*Walnut
Wolf
Wolf
Wolfley

BUTLER COUNTY

Avery
Baker
Bemis
Cole
Diagonal
Dry
Durachon
Durham
*East Branch Walnut River
Eightmile
Fourmile
Fourmile
Gillion
Henry
Hickory
Hog
Indianola
Ivanpah
Little Walnut
Muddy
Pole Cat
Rock
Rock
Satchel
Thurman
Turkey
*Walnut River
Wentworth
West Branch Walnut River
West Whitewater
*Whitewater

CHASE COUNTY

Baker
Bitts
Bruno
Buckeye
Cedar
Coon
*Cottonwood River
Craik
Crocker
Diamond
Fox
Gannon
Indian
Jacob
Little Cedar
Mercer
Middle Cedar
*Middle Cottonwood
Peyton
Rock
Shaffer
Silver
Simmon, Simon
Sixmile
*South Fork Cottonwood River
Spring
Stribby
Thurman
*Verdigris River

CHAUTAUQUA COUNTY

Bee
Berry
Big Cana
*Caney
Cedar
Coon
Deer
Grant
Harpers
Middle Cana
North Cana
Otter
Pool
Rock
Salt
Shanghai
Spring
Spring
Sycamore
Turkey
Wolf

CHEROKEE COUNTY

Bitter
Brush
Center
*Cherry
Cow
Cow
Deer
Denny Branch Cherry
Fly
Four Mile, Four-mile
Four Mile, Four-mile
*Lightning
Little Cherry
Little Fly
Little Shawnee
Long Branch Cow
Millersberg
Mulberry
*Neosho River
Plum
Shawnee
Shoal
Short
*Spring River
Stink Branch Lightning
Tarr
Taylors Branch Cow
Turkey
Willow
Wolf

CHEYENNE COUNTY

*Arikaree River
Arnold Harvey Canyon
Bartlett Canyon
Battle
Big Timber
Bluff
Carroll Canyon
Cherry
Cherry
Cleveland Run
Cowage
Dave Harvey Canyon
Delay
Devil
Devils Canyon
Fish
Hackberry
Hay Canyon
Heinzelmann Canyon
Hells Canyon
Henkle Canyon
Henkles
Jackson Canyon
Jarvis Canyon
Jones Canyon
Little Beaver
Maqnani Canyon
McCann Canyon
Morehouse Canyon
North Fork Beaver
North Fork Cherry
Patterson Canyon
Pig Canyon
Plum
Sand
Sand Canyon
Sawyer Canyon
Selwyhart Canyon
Sleepy
Sleepy Canyon
Smutz Canyon
*South Fork Republican River
Spring
Sullivan Draw
Trail Canyon
Valley
West Fork Burntwood
White Canyon
Will Stafford Canyon
Wilson Canyon
Wolfe Canyon

CLARK COUNTY

Antelope
Bear
Big Sandy
Bluff
Bullard
Cavalry
*Cimarron River
Clark
Day
Fish
Granger
Hackberry
Kiger
Little Sandy
Redhole
Sand
Snake
Spring
Trout

CLAY COUNTY

Badger
Bostick
Chapman
Fancy
Fivemile
Moll
McMurray
Miller
Mud
Mulberry
Peets
Quimby
*Republican River
School
South Branch Fivemile
Spring
Timber
West Branch Chapman

CLOUD COUNTY

Buffalo
East Pipe
East Wolf
Elk
Elm
Fisher
Middle Pipe
Mortimer
Oak
*Republican River
Salt
*Solomon River
Third
West Pipe
West Wolf
White
Wolf
Yockley

COFFEY COUNTY

Badger
Benedict
Big
Bowman
Crooked
Dinner
Duck
Eagle
Eagle
Frog
Frog
Hickory
Lebo
Long
Long
Loss
*Neosho River
North Long
Otter
Pottawatomie
Rock
Rock
Scott
South Fork Big
Spring
Troublesome
Turkey
Twiss
Varvel
Wolf

COMANCHE COUNTY

Bluff
Cavalry
Cimarron River
Indian
Mule
Mustang
Nescatunga
Red Fork
Salt Fork
Sand
Sand

COWLEY COUNTY

*Arkansas River
Badger
Beaver
Black (Crook?)
Bullington
Cedar
Durham
Dutch
Eckler Canyon
Eightmile
*Grouse
Johnson Hollow
Little Beaver
Little Beaver
Little Cedar
Lone Elm
Maple
Myers
Muddy
Muddy
Nigger
Otter
Panther
Plum
Plum
Pole Cat
Richland
Rock
Rock
Rock
Salt
Sand
School
Shellrock
Silver
Skull
Spring
Spring
Spring
Stewart
Timber
*Walnut River
Wild Cat

CRAWFORD COUNTY

Big Walnut
Bone
Brush
Clear
Cow
Cow
Cox
Dry Branch Cox
Drywood
East Cow
Elm
First Cow
Grindstone
Hickory
*Lightning
Lime
Limestone
Little Cow
Little Pawnee
Little Walnut
Middle Cow
Murphy
Owl
Paint
Pawnee
Pony
Second Cow
Second Nicholson
Taylor Branch Cow
Thunderbolt
Walnut
West Elm Branch Dry Wood
West Fork Dry Wood
Wolf

DECATUR COUNTY

*Beaver
*Middle Fork Sappa
*North Fork Prairie Dog
*North Fork Sappa
*North Fork Solomon River
*Prairie Dog
*Sappa
*South Fork Prairie Dog
*South Fork Sappa

DICKINSON COUNTY

Abilene
Cary
*Chapman
Coal
East Turkey
Holland
Lime
Lyons
Mud
*Republican River
School
*Smoky Hill River
Turkey
West Branch Lyons
West Turkey

DONIPHAN COUNTY

Brush
Cedar
Clear
Independence
Mill
Mission
*Missouri River
Mosquito
*Peters
Rock
Squaw
Walnut
Wolf

DOUGLAS COUNTY

Appanoose
*Baldwin
*Captain
[Chicken]
*Cole
[Coleman]
*Coon
[Coon]
*Deer
Dry Branch Deer
[East Fork Tauy]
Eightmile, Eight Mile
*Elk
Great
*Kansas River
*Little Wakarusa
[Middle Tauy]
*Mud
*Oakley
*Rock
*Spring
[Spring]
*Spring
Tauy
Wade
*Wakarusa River
*Washington
West Tauy
[Wymore]
*Yankee Tank

EDWARDS COUNTY

[*Arkansas River]
Big Coon
Coon
Little Coon
*Rattlesnake

ELK COUNTY

Bachelor
Clear
Coon
Elk
*Elk River
*Fall River
Fall River?
Ham
Hickory
Hutchins
Indian
Little Indian
Little Salt
Middle Painterhood
Mound
Painterhood
Pawpaw
Rainbow
Rock
Salt
Snake
South Duck
Wild Cot

ELLIS COUNTY

*Big
[*Big Timber]
*Duck
*Eagle
Lockout Hollow
*North Fork Big
*Saline River
*Smoky Hill River
Walker
[Wanmadden]

ELLSWORTH COUNTY

Alum
Ash
Blood
Bluff
Buffalo
Clear
Cow
East Elkhorn
Mud
Oak
Oxide
Plum
*Smoky Hill River
Spring
Table Rock
Thompson
Turkey
West Spring
Wilson
Wolf
Wolf

FINNEY COUNTY

*Arkansas River
*Pawnee River

FORD COUNTY

*Arkansas River
Big Coon
Coon
Cow
Crooked
Duck
Elm
Five Mile
Mulberry
Rattlesnake
Sawlog
Spring

FRANKLIN COUNTY

Appanoose
Coal
Eightmile, Eight Mile
Eightmile, Eight Mile
Hardfish
Hickory
Iantha
Kelsey
*Kenoma
Marais des Cygnes River (Osage River)
*Middle (Osage River)
Marais des Cygnes River
Ottawa
*Pottawatomie
Rock
Sac
Tauy
Tauy
Turkey
Walnut

GEARY COUNTY

Breakneck Canyon
Briggs Branch Swede
Clark (Clarke)
Curtis
Deadman
Dry
East McDowell
Farnum
Harvey Canyon
Horne Branch East McDowell
Humboldt
*Kansas River
Lyons
Madison
Magazine Canyon
McArthur Branch West McDowell
McDowell
Otter
Pool Branch East McDowell
*Republican River
Rock Springs Canyon
Rush
School
*Smoky Hill River
Spring
Pressee Branch McDowell
Pumphouse Canyon
Swede
Thierer Branch West McDowell
Thomas
West McDowell

GOVE COUNTY

[*Big]
Castle Rock
*Hackberry
Hell
Indian
Plum
*Smoky Hill River

GRAHAM COUNTY

Bow
Brush
Jackson
*North Fork Saline River
*Saline River
Sand
Skunk
*South Fork Solomon River
Wild Horse

GRANT COUNTY

Bear
*Cimarron River
North Fork Cimarron River
South Fork Cimarron River

GRAY COUNTY

*Arkansas River
Crooked

GREELEY COUNTY

Beaver
*Ladder
White Woman

GREENWOOD COUNTY

Bachelor
Badger
Bernard
Burnt
Carlisle, Carlisle Branch, Verdigris River
Casner
Cedar Hollow
Coon
Durham
East Fall River
*Fall River
Halderman
Hog
Homer
Honey
Indian
Ivanpah
Kuntz
Little Salt
North Branch Otter
Oleson
Otis
*Otter
Pike
Plum
Ross Branch Verdigris River
Salt
Shawnee
School
Slate
Snake
South Fork Otter
Spring
Swing
Tadpole
Van Horn
*Verdigris River
Walnut
West
West Branch Fall River
Wilhites
Willow

HAMILTON COUNTY

*Arkansas River
Sand

HARPER COUNTY

Bachelor
Baehr
Bear
Beaver
Big Sandy
Bluff
Camp
*Chikaskia River
Clearwater
Cottonwood
East Branch Bluff
East Sand
East Spring
Little Sandy
Middle Branch Bluff
Plum
Rock
Rush
Sand
Sandy
Sandy
Silver
Spring
Spring
Spring Branch Bluff
West Branch Bluff
West Sandy
West Whitewater
Wild Cat
Willow

HARVEY COUNTY

Beaver
Black Kettle
Blaze Fork
Crooked
Doyle
Dry
East Emma
East Whitewater
Elm
Emma
Gooseberry
Gypspm
Jester
Kiswa
*Little Arkansas River
Middle
Mud
Sand
Sun
Turkey
Walnut River
West Emma
West Whitewater River
Wild Cat

HASKELL COUNTY

Cimarron River

HODGEMAN COUNTY

Buckner
Cottonwood
Dry
*Pawnee River
Pawnee Fork
Pawnee River
Rock
Sawlog
Spring

JACKSON COUNTY

*Big Soldier
Cedar
Cedar
Cross
*Delaware River
Elk
Illinois
Little Cross
Little Soldier
Mosquito
Mud
Muddy
*Soldier
Spring
Straight
Walnut

JEFFERSON COUNTY

Big Muddy
Big Slough
Bowie
Brush
*Buck
Cedar
Coal
Crooked
*Delaware River
Duck
East Stone House
Elm
Evan
Fall
Fishpond
Honey
Howard
Hull
Indian
*Kansas River
Little Muddy
Little Slough
Little Wild Horse
Mooney
Mud
Muddy
Ninemile
North Walnut
Plum
Pony
Prairie
*Rock
Rock
Scatter
Scott
Slough
South Fork Fall
Spring
Stonehouse, Stone House
Tonganoxie
Walnut
Walnut
West Stone House
Wild Horse
Wild Horse

JEWELL COUNTY

Buffalo
Burr Oak
East Marsh
East Oak
Limestone
Plum
Porcupine
*Republican River
West Limestone
West Limestone
West Marsh
White Rock

JOHNSON COUNTY

Big Bull
*Big Blue River
Brush
*Captain
Cedar
Clear
Coffee
Coon
Dyke Branch Indian
Indian
James Branch Indian
*Kansas River
Kill
Little
Little Cedar
Little Mill
Mill
Tomahawk
Turkey
Wolf

KEARNY COUNTY

*Arkansas River

KINGMAN COUNTY

Allen
Big Spring
Blue Stem
Clearwater
Coon
Copper
Cross
Duck
Fish
Goose
Kemp
[*Chickaskia River]
Mead
Negro
Nester
*Ninnescah River
*North Fork Ninnescah River
Painter
Pat
Peters
Petyt
Red
Rose Bud
Sand
Sand
Sandy
*Smoot
*South Fork Ninnescah River
Spring
Sweetwater
Walnut
Wild Horse
Wild Run

KIOWA COUNTY

*Arkansas River
*Medicine Lodge River
*Rattlesnake
Sand
Thompson

LABETTE COUNTY

Bachelor
Big
Big Hill
Deer
Deer
Elm
Hackberry
Hickory
Labette
Lake
*Lightning
Little Bachelor
Little Labette
Litup
Mud
*Neosho River
Pumpkin
Richland
Rock
Snow
Spring
Tolen
Town
Turkey
Wild Cat, Wildcat

LANE COUNTY

*North Fork Walnut
*South Fork Walnut

LEAVENWORTH COUNTY

Ashby
*Big Stranger
Branch
Brush
Buckhorn
Buttermilk
Corral
Cow
Cramer
Dawson
Fall
Fivemile
Hog
Island
Jacob
Jarbalo
*Kansas River
Kent
Little Kaw
Little Plum
Little Sandy
Little Snell
*Little Stranger
Little Walnut
*Missouri River
Mud
Murray
Ninemile
Ninemile
Onemile
Oppossum Hollow
Owl
Plum
Pony
Quarry
Rock
Salt
Scott
Sevenmile, Seven Mile
South Fork Fall
*Stranger
Threemile
Tonganoxie
Walnut
Walnut
West Brush
Wild Horse
Wolf

LINCOLN COUNTY

Bacon
Battle
Beaver
Brison Branch
West Bacon
Brush
Bullfoot, Bull Foot
Coal
Cottonwood Hollow
Cow
Dry
East Bacon
East Elkhorn
East Twin
Elkhorn
Elm
Hell
Horse
Little Timber
Lost
Mule
Nigger
North Branch Spillman
North Branch Spillman
Owl
Prosser
*Rattlesnake
*Saline River
Salt
Second
South Branch Spillman
Spillman
Spring
Spring
Table Rock
Third
Trail
Twelvemile,
Twelve Mile
West Bacon
West Elkhorn
West Twin
Wolf
Yeauger

LINN COUNTY

*Big Sugar
Davis
Elk
Elm
Hushpuckney
Indian
Little Sugar
Lost
*Marais des Cygnes
River (Osage River)
Middle
Mine
*North Sugar
(Osage River)
Marais des
Cygnes River
Owl
Richland
South Fork Big Sugar
Sugar
Turkey

LOGAN COUNTY

Burris Draw
*Butte
Castle Rock
*Chalk
*Hackberry
Hell
Ladder
Middle Hackberry
North Fork Smoky
Hill River
North Hackberry
*Smoky Hill River
South Hackberry
Twin Butte

LYON COUNTY

Allen
Badger
Bluff
Camp
Chicken
Coal
*Cottonwood River
Dows
Duck
Eagle
Elm
Fawn
Fourmile
Fowler Harper
Hill
Hoosier
Indian
Jacob
Marais des Cygnes River (Osage River)
Moon
*Neosho River
One Hundred and Forty Mile
Onion
*(Osage River) Marais des Cygnes River
Phenis
Plumb
Rock
Rock
South Branch Eagle
Stillman (Switzler)
Tate
Taylor
*Verdigris River
Wright

MARION COUNTY

Antelope Spring Branch Cottonwood River
Brook Luta
Bruno
Clear
*Cottonwood River
Doyle
East
East
East Branch Clear
French
Martin
Middle
Middle Branch Turkey
Mud
Parker
Perry
*South Cottonwood River
*South Fork Cottonwood River
Spring
Spring
Whitewater

MARSHALL COUNTY

Alcove Spring
*Big Blue River
*Black Vermillion River
Clear
Coon
Elk
Horseshoe
Lily
*Little Blue River
Little Timber
Little Walnut
Manley
Mosquito
Mountain
Oikeirman
Raemer
Roemer
Robidoux
South Fork Black Vermillion River
*South Fork Black Vermillion River
*Spring
*Vermillion
Walnut

McPHERSON COUNTY

Big Slough
Blaze Fork
Crooked
Dry Turkey
Edwards
Gypsum
Hoover
Indian
Kentuck
*Little Arkansas River
North Branch Sharps
North Gypsum
Paint
Pawnee
Running Turkey
Sharps
*Smoky Hill River
South Sharp
Turkey
West Branch Turkey
West Emma
Wolf
Wolf

MEADE COUNTY

*Cimarron River
*Crooked
North Branch Sand
Sand
Shorts
Spring

MIAMI COUNTY

Bell
*Big Bull
Bull
Cottonwood
Dorsey
Drummond Branch Big Bull
Elm
Elm
Elm
Granny
Hushpuckney
Jake
Little Bull
*Marais des Cygnes River (Osage River)
McFadden
*Middle (Osage River) Marais des Cygnes River
Plum
*Pottawatomie
Rabbit
Rock
Roger
Roger
Scott
Sixmile
Smith
Sugar
Sweetwater
Tenmile
Tucker
Tuggle
Turkey
Wade
Walnut
Walnut
Walnut
Wea
Wolf

MITCHELL COUNTY

Antelope
Asher
Bacon
Brown, Browns
Carr
Clay
Cole
Dog
Dry
East Asher
East Bacon
East Branch Browns
Elm
Fifth
Fourth
Fourth
Frog
Granite
Hardscrabble
Hermes
Indian
Leban
Limestone
Little
Little Walnut
Marshall
Mill
*North Fork Solomon River
Oak
Plum
Ratcliff
Rock
Salt
Second
Sixth
*Solomon River
*South Fork Solomon River
Spring
Third
Turkey
Walnut
West Asher
West Bacon
West Branch Browns
West Fork Mulberry
West Rock

MONTGOMERY COUNTY

Bachelor
Bee
Big Hill
Bluff
Caney
Cherry
Chetopa
Cheyenne
Choteau
Claymore
Clear
Coal
Coon
Cotton
Crow
Deadman
Drum
Duck
Duck
*Elk River
Elm
Elm
Elm
Fawn
Foster
Gordon
Hater
Irish
Mouse
Mulberry
Onion
Persimmon
Potato
Prior
Pumpkin
Racket
Salt
Salt
Silver
Snow
Spring
Spring
Sycamore
Turkey
*Verdigris River

MORRIS COUNTY

Big John
Bluff
Canning
Clark, Clarks
Crooked
East
Elm
Fourmile
Gilmore
Haun
Indian
Lairds
Lards
Level
Little John
Middle
Mission
Mozler
Mulberry
Munker
*Neosho River
Parker
Ralls
Ramsey
Richie
Rock
Short
Sixmile, Six Mile
Slough
Spring
*West Fork Neosho River
*West Fork Neosho
Wild Cat

MORTON COUNTY

Cimarron River
North Fork Cimarron River

NEMAHA COUNTY

Balls
*Black Vermillion River
Cedar
Clear
Coal
Craig
Deer
Harris
Illinois
Locklane
Manley
Mathews
Mosquito
*Red Vermillion
*South Fork Nemaha River
Spring
Turkey
Webster
Wild Cat
Wolfley

NEOSHO COUNTY

Bachelor
Big
Big Walnut
Big Walnut
Brogan
Canville
Chetopa
Downey
Draw
Elk
Flat Rock
Fourmile
Hickory
Labette
Little Canville
Little Elk
Little Labette
Little Turkey
Little Walnut
Mud
Murphy
*Neosho River
Neosho River Cut-off
Ogeese
Pecan
Rock
Slough
Spring Branch Fourmile
Sutton
Tolen
Turkey
Vegetarian
Village
Walnut

NESS COUNTY

Alexander
Alexander Dry
Bazine
Big Timber
Booth
Dry
Guzzler Gulch
North Fork Walnut
Pawnee Fork
Pawnee River
*Pawnee River
South Fork Walnut
*Walnut
Wild Horse

NORTON COUNTY

Big Timber
*Prairie Dog
*Sappa
Scull
*Solomon River

OSAGE COUNTY

Beach
Bower
Burys
Cherry
Cole
Dragoon
Dry
Elk
Frog
Higby
Hundred and Ten Mile
Jersey
Johnson
Kibbie
Long
*Marais des Cygne River (Osage River)
Mute
(Osage River) Marais des Cygnes River
Plum
Plumb
Plumer
Rock
*Salt
Smith
Soldier
Stowbridge
Swede
Switzler
Tugua
Valley

OSBORNE COUNTY

Carr
Coon
Covert
Crooked
Dry
Eagle
Eagle Tail
East
East Fork Wolf
East Kill
Elm
Indian
Joy
Kill
Lawrence
Lindley
Medicine
*North Fork Solomon River
Oak
*Paradise
Skunk
*South Fork Solomon River
Twelvemile
Twin
West Wolf
Wolf

OTTAWA COUNTY

Chapman
Coal
Cool
Cow
East Pipe
First
Limestone
Lindsey
Middle Pipe
Mortimer
Pipe
Rattlesnake
*Saline River
Salt
Sand
*Solomon River
Stone
West Pipe
Yockley

PAWNEE COUNTY

*Arkansas River
Ash
Big Coon
Coon
Hubbard
Pawnee
*Pawnee River
Sawmill

PHILLIPS COUNTY

Ash
Big
Bissell
Bouthton
Bow
*Deer
Hawson
*North Fork Solomon River
Plotner (Plotter?)
Plotter (Plotner?)
Plum
*Prairie Dog
*Solomon River
Spring
West Cedar
Wolf

POTTAWATOMIE COUNTY

Adams
*Big Blue River
Bluff
Brush
Camp
Carnahan
Clear
Clear
Coal
Coal
Cross
Darnell Ranch Rock
Dutch
East Fork Rock
Fourmile
Indian
Jim
*Kansas River
McIntire
Meyano
Mill
Mill
*Red Vermillion
Rock
Straight
*Vermillion River
Wilson

PRATT COUNTY

Sand
*South Fork Ninnescah River
Turkey
Turkey

RAWLINS COUNTY

*Beaver
Burntwood
East Fork Burntwood
Little Beaver
*Middle Beaver
Middle Fork Sappa
*North Fork Sappa
Salt
*South Beaver
*South Sappa
*West Fork Burntwood

RENO COUNTY

Afton
*Arkansas River
Big Slough
Blaze Fork
Bull
Clear
Clearwater
Coon
Cow
*Cowskin
Devils Ditch
Dry
Fish
Goose
Jocelyn
Kiswa
*Little Arkansas River
Middle Branch Clearwater
Mud
*Ninnescah River
*North Fork Ninnescah River
Peace
Polecat
*Rattlesnake
Rock
Salt
Sand
Silver
Smoots
*South Fork Ninnescah River
Spring

REPUBLIC COUNTY

Beaver
Buffalo
Camp
Cool
Coon
Dry
East
East Marsh
Elk
Lost
Mill
Mud
Oak
Otter
Otter
*Republican River
Riley
Rose
Salt
School
Spring
West Elk
West Marsh
West Salt
White Rock

RICE COUNTY

*Arkansas River
*Big Cow
Bull
Calf
Cow
Dry
Dry Run
Horse
Jarvis
*Little Arkansas River
Little Cow
Long
Lost
North Fork Little Arkansas River
Owl
Peace
Plum
Plum
Rattlesnake
Sand
Sharps
Spring
Wolf

RILEY COUNTY

*Big Blue River
Breakneck Canyon
Clark (Clarke?)
Coyote Canyon
Crooked
Davis
Deep
Dry
Dry Branch Kansas River
Fancy
File
Fourmile
Harvey Canyon
Honey
*Kansas River
Kitten
Little Arkansas
Little Kitten
Long Draw
Madison
Magazine Canyon
McDowell
Mill
North Branch Fancy
North Otter
One Mile
Otter
Pressee Branch McDowell
Pump House Canyon
*Republican River
Rock Springs Canyon
Rush
Sevenmile, Seven Mile
Silver
Swede
Threemile, Three Mile
Timber
Tuttle
Walnut
Wild Cat
Wind
Wolf Canyon

ROOKS COUNTY

Bow
Boxelder
Eagle
Elm
Elm
Lost
Medicine
*Paradise
Sand
*South Fork Solomon River

RUSH COUNTY

*Big Timber
Booth
Buck
Dry Walnut
Duck
Eagle
Little Walnut
Old Maids Fork Walnut
Otter
*Sand
Sandy
Shelter Timber
*Walnut

RUSSELL COUNTY

Beaver
Big
Big
*Cedar
Coal
Coon
East Fork Wolf
Fossil
Four Mile
Hell
Landon
*Paradise
*Saline River
*Salt
Seller
*Smoky Hill River
West Fork Wolf
Wolf
Wright

SALINE COUNTY

Dry
East Dry
*Gypsum
Harvey
Hobbs
Kentuck
McAllister
Middle Dry
*Mulberry
Pawnee
*Saline River
Shaw
*Smoky Hill River
*Solomon River
Spring
Stag
West Dry
West Gypsum
West Spring

SCOTT COUNTY

Battle Canyon
Battendorf Canyon
Christy Canyon
Epler Canyon
Garvin Canyon
Horsethief Canyon
Landon Draw
*Ladder
Lion
Morgan Draw
Rocky Draw
Sand
Sand Draw
Shafer Canyon
Timber Canyon
White Woman, Whitewoman

SEDGWICK COUNTY

Afton
*Arkansas River
Big Slough
Chisholm
Clear
Clearwater
*Cowskin
Diagonal
Dry
Dry
Dry
East Fork Chisholm
Eight Mile
Emma
Fourmile
Fourmile
Gillion
Gooseberry
Gypsum
Indianola
Jester
Jocelyn
*Little Arkansas
Little Slough
Middle Fork Chisholm
Mud
*Ninnescah River
*North Fork Ninnescah River
Polecat, Pole Cat
Prairie
Rock
Sand
Sand
*South Fork Ninnescah River
Spring
Spring
Spring
Spring
Spring
Spring Branch Fourmile
*Walnut River
West Fork Chisholm
West Whitewater
Whitewater
*Whitewater River
Wild Cat

SEWARD COUNTY

*Cimarron River

SHAWNEE COUNTY

*Big Soldier
Blacksmith
Bourbony
Burys
Cow
Cross
Deer
Deer
Halfday
Indian
*Kansas River
Little Muddy
Little Soldier
Lynn
Mission
Muddy
Post
Shonganunga, Shunganunga
Sixmile
Stinson
Stowbridge
Tecumseh
Vassar
Wade
*Wakarusa River
Walnut
Whetstone

SHERIDAN COUNTY

Bow
*North Fork Solomon River
*Prairie Dog
*Saline River
Sand
South Bow
*South Fork Solomon River
Spring Brook

SHERMAN COUNTY

*Beaver
*Middle Fork Sappa
*North Fork Sappa
*North Fork Smoky Hill River
*South Fork Solomon River
*South Fork Sappa

SMITH COUNTY

Bachelor Run
Beaver
Buck
Cedar
Cottonwood
Dry
Dry
Dry
East Beaver
East Cedar
East Fork Medicine
East Oak
Glen
Honey
Iowa
Madison
Medicine
Mid Cedar
*Middle Beaver
Middle Cedar
Middle Oak
Monkey Run
North Fork Solomon River
Oak
Pawnee
Plum
*Solomon River
Spring
Spring
Spring Branch
Twelve Mile
Troublesome
Twelve Mile
Walnut
West Beaver
White Rock
Wolf

STAFFORD COUNTY

*North Fork Ninnescah River
Peace
*Rattlesnake
Spring
Wild Horse, Wildhorse

STANTON COUNTY

Bear
Bear
North Fork Cimarron River
Sandy Arroyo

STEVENS COUNTY

*Cimarron River
North Fork Cimarron River

SUMNER COUNTY

Antelope
Antelope
Argonia
Argyle
*Arkansas River
Avon
Badger
Beaver
Beaver
Bitter
Bitter
Bluff
*Chikaskia River
Cowskin
Deer
Dog
East Branch Fall
East Branch Prairie
East Prairie
Elm
Fall
Garvey
Jordan
Long
Meriden
Middle Shoo Fly
*Ninnescah River
Oak
Prairie
Rodger
Salt
Sand
Sand
Shore
Short
Silver
Silver
Slate
Snyder
Spring
Spring
Spring
Spring
Spring
Turkey
Turtle
West Branch Prairie
West Prairie
West Shoo Fly
Winser
Wolf

THOMAS COUNTY

Middle Fork Sappa
North Fork Saline River
*North Fork Sappa
North Fork Solomon River
Prairie Dog
*Saline River
*Sappa
South Fork Saline River
South Fork Sappa
South Fork Solomon River
South Sappa?

TREGO COUNTY

*Big
Downer
East Branch Downer
Ogallah
Page
*Saline River
Sand
*Smoky Hill River
Spring
Trego

WABAUNSEE COUNTY

Allen
Antelope
Chicken
Dragoon
Dry
East Branch Mill
Hendricks
Horse
Illinois
*Kansas River
Kinsley
Locust
*Marais des Cygnes River (Osage River)
Middle Branch Mill Creek
*Mill
Mission
Mission
Mulberry
Nehring
Onion (Osage River)
Marais des Cygnes River
Pawpaw
Pierce
Pretty
Robert
Rock
Rock
Snokomo
Soldier
South Branch Mission
Spring
Turkey
Wells
West Branch Mill

WALLACE COUNTY

Eagletail
Hackberry
*Ladder
North Fork Smoky Hill River
*Smoky Hill River
Turkey
Turtle
Twin Butte

WASHINGTON COUNTY

Ash
Beaver
Bowman
Camp
Camp
Coon
Coon
Cottonwood
Davis
Dry
East Branch Gar
Gar
Herbert
Iowa
*Little Blue River
Malone
Melvin
Mill
Myer
North Branch Fancy
Parsons
Peets
Riddle
Salt
Scribners
Spring
Stub
Sulphur
Tall
Zeka

WICHITA COUNTY

*Beaver
*Ladder
Rocky Draw
Sand
Whitewoman, White Woman

WILSON COUNTY

Big Cedar
Brush
Buffalo
Chetopa
Clear
Coon
Crooked
Dry
Duncan
East Buffalo
East Cedar
East Cedar
Elders
Elders Branch Buffalo
*Fall River
Fall River
Great House, Greathouse Indian
Little Cedar
Little Sand
Little Sandy
Meadow
Middle Duck
Pig
Plum
Plum Branch Fall River
Pumpkin
Rainbow
Rock
Rose
Ross
Ross Branch Verdigris River
Salt
Sandy
Scott
Silver
Snake
South Duck
Sutton
Sutton Branch Verdigris River
Sycamore
Teeters Branch Fall River
*Verdigris River
Village
Walnut
Washington Branch Verdigris River
West Cedar
Willow
Woodruff
Woodruff Branch Buffalo

WOODSON COUNTY

Big Sandy
Buffalo
Carlisle Branch Verdigris River
Cedar
Cherry
Duck
East Buffalo
Little Sandy
*Neosho River
Owl
Plum
Rock
Sandy
Scatter
South Owl
Spring
Turkey
*Verdigris River
West Buffalo

WYANDOTTE COUNTY

Bell
Betts
Big Eddy
Brenner Heights
Clear
Connor
East Mission
Eddy
Honey
Island
Jersey
*Kansas River
Little Kaw
Little Turkey
Malone Hollow
Mill
Mill
*Missouri River
Muncie
Nearman
Spring
Turkey
West Mission
Wolf

LITERATURE CITED

Anon.
1945. Tenth Biennial Report of the Forestry, Fish and Game Commission, for the period ending June 30, 1944, State of Kansas. Pp. 1-41. Kansas State Printer, Topeka, Kansas.

Bailey, V.
1927. Beaver Habits and Experiments in Beaver Culture. U. S. Dept. Agric., Tech. Bull. 21:1-39, 14 pls., 7 figs.

Baker, A. B.
1889. Mammals of Western Kansas. Trans. Kansas Acad. Sci., 11:56-58.

Black, J. D.
1938. Mammals of Kansas. Kansas State Board of Agric. Thirtieth Biennial Report, pp. 115-217.

Bradt, G. W.
1938. A Study of Beaver Colonies in Michigan. Jour. Mamm., 19:139-162.
1947. Michigan Beaver Management. Michigan Dept. Conserv., Game Div., 56 pp., illustrated.

Bright, J. D.
1956. Kansas, The First Century. Vol. 1, Lewis Historical Publ. Co., Inc., New York. Pp. xix + 552, illustrated.

Cammack, J. P.
1932. Fourth Biennial Report of the Forestry, Fish and Game Commission of the State of Kansas, for the period ending June 30, 1932. Pp. 1-49. Kansas State Printer, Topeka, Kansas.

Chittenden, H. M.
1935. The American Fur Trade of the Far West. Vol. 1, pp. xxx + 482, 2 photos. Barnes & Noble, Inc., New York.

Clapp, A.
1930. Third Biennial Report of the Forestry, Fish and Game Commission of the State of Kansas, for the period ending June 30, 1930. Pp. 1-39. Kansas State Printer, Topeka, Kansas.

Cockrum, E. L.
1952. Mammals of Kansas. Univ. Kansas Publ., Mus. Nat. Hist., 7:1-303, 37 figs.

Denney, R. N.
1952. A Summary of North American Beaver Management, 1946-1948. Colorado Game and Fish Dept., Current Report 28, vii + 58 pp., 27 figs. (Processed, not printed.)

Doze, J. B.
1924. Fifth Biennial Report of the Kansas State Fish and Game Department, for the two years ending June 30, 1924. Pp. 1-52. Kansas State Printer, Topeka, Kansas.

Dyche, L. L.
1907. A Kansas Beaver. Trans. Kansas Acad. Sci., 21 (pt. 1):165-167.

Grasse, J. E., and Putnam, E. F.
1950. Beaver Management and Ecology in Wyoming. Wyoming Game and Fish Comm. Bull. 6, 52 pp.

Grinnell, G. B.
1923. Bent's Old Fort and Its Builders. Colls. Kansas State Historical Soc. . . . 15:28-91.

Hall, E. R.
1955. Handbook of Mammals of Kansas. Univ. Kansas Publ., Mus. Nat. Hist. Misel. Publ. No. 7:1-303, 99 numbered figures and other illus.

HANS, F. L.
1936. Sixth Biennial Report of the Forestry, Fish and Game Commission of the State of Kansas, for the period ending June 30, 1936. Pp. 62. Kansas State Printer, Topeka, Kansas.

HAY, K. G., and RUTHERFORD, W. H.
1956. A Guide to Beaver Trapping and Pelting. State of Colorado Dept. Game and Fish, Tech. Bull., 3:1-20, illustrated.

HAY, O. P.
1914. The Pleistocene Mammals of Iowa. Iowa Geological Survey. Vol. 23 (Annual Report, 1912), xlvii + 662, 75 pls., 142 figs.

HIBBARD, C. W.
1933. A Revised Check List of Kansas Mammals. Trans. Kansas Acad. Sci., 36:230-249.

HONESS, R. F., and WINTER, K. B.
1956. Diseases of Wildlife in Wyoming. Wyoming Game and Fish Commission, Bull. 9:1-279, illustrated.

JOSSERAND, C. D.
1941. Eighth Biennial Report of the Forestry, Fish and Game Commission, State of Kansas, for the period ending June 30, 1940. Pp. 1-28. Kansas State Printer, Topeka, Kansas.

KNOX, M. V. B.
1875. Kansas Mammalia. Trans. Kansas Acad. Sci., 4:19-22.

LANE, H. H.
1947. Survey of the Fossil Vertebrates of Kansas, Part V: The Mammals. Trans. Kansas Acad. Sci., 50:273-314, 9 figs.

LANTZ, D. E.
1905. Kansas Mammals in their Relations to Agriculture. Kansas State Agricultural College Bull. 129:331-404.

LEAHY, D.
1947. Eleventh Biennial Report of the Forestry, Fish and Game Commission, State of Kansas, for the period ending June 30, 1946. Pp. 1-45. Kansas State Printer, Topeka, Kansas.

MCCRACKEN, H., and VAN CLEVE, H.
1947. Trapping, the Craft and Science of Catching Fur-bearing Animals. A. S. Barnes Co., New York, pp. vii + 196, illustrated.

MORGAN, L. H.
1868. The American Beaver and his Works. J. B. Lippincott & Co., Philadelphia. Pp. xv + 330, illustrated.

NAGEL, W. O.
1946. The Beaver—History Maker—Is Coming Back. Missouri Conservationist, 7(9):6-8, 16, illustrated.

PLATT, R.
1957. Walt Disney's Worlds of Nature. Golden Press, New York, pp. 1-176, illustrated.

PRESNALL, C. C.
1943. Wildlife Conservation as Affected by American Indian and Caucasian Concepts. Jour. Mamm., 24:458-464.

SCHOEWE, W. H.
1951. The Geography of Kansas. Part III, Hydrogeography. Trans. Kansas Acad. Sci., 54:263-329, figs. 56-70.

SCHWARTZ, C. W., and SCHWARTZ, E. R.
1959. The Wild Mammals of Missouri. Univ. Missouri Press. Pp. 12-341, Col. frontispiece, illustrated.

SETON, E. T.
1937. Lives of Game Animals. Doubleday, Doran & Co., Inc. New York, Vol. 4, pt. 2, pp. 441-949, illustrated.

STAINS, H. J., and BAKER, R. H.
1958. Furbearers in Kansas: A Guide to Trapping. Univ. Kansas Mus. Nat. Hist. Misel. Publ. No. 18, pp. 1-100, 2 pls., 13 figs.

STIRTON, R. A.
1935. A Review of the Tertiary Beavers. Univ. California Publ., 23:391-457, 142 figs., 2 charts.

STRONG, W. G.
1935. Fifth Biennial Report of Forestry, Fish and Game Commission of the State of Kansas, for the period ending June 30, 1934. Pp. 1-63. Kansas State Printer, Topeka, Kansas.

SWANK, W. G.
1949. Beaver Ecology and Management. Conserv. Comm. of West Virginia, Game Mgt. Div., Bull. 1, 65 pp.

WALL, R.
1939. Seventh Biennial Report of Forestry, Fish and Game Commission . . . of the State of Kansas, for the period ending June 30, 1938. Pp. 52 (unnumbered), illustrated.

WARREN, E. R.
1927. The Beaver, its Work and its Ways. The Williams & Wilkins Co., Baltimore. Monog. Amer. Soc. Mamm., 2:xx + 177, 78 Figs.

[WOOSTER, L. D.]
1959. Weather Cycle-pattern Makes Possible Long-time Planning. The West Kansan, 10(No. 2):[pp. 2-3].

Transmitted August 15, 1960.

□

28-4990

Institutional libraries interested in publications exchange may obtain this series by addressing the Exchange Librarian, The University of Kansas, Lawrence, Kansas.

Requests of individuals are handled instead by the Museum of Natural History, The University of Kansas, Lawrence, Kansas. There is no provision for sale of this series either by the Library or the Museum. However, when individuals request copies from the Museum, the amount indicated below should be included for the purpose of defraying some of the costs of producing, wrapping and mailing.

Nos. 6, 12, and 17 obtainable only from the Arctic Institute.

*1. The Museum of Natural History, the University of Kansas. By E. R. Hall and Ann Murray. Pp. 1-16, illustrated. January 5, 1946.

*2. Handbook of Amphibians and Reptiles of Kansas. By Hobart M. Smith. Pp. 1-336, 233 figures in text. September 12, 1950.

3. In Memoriam, Charles Dean Bunker, 1870-1948. By E. Raymond Hall. Pp. 1-11, 1 figure in text. December 15, 1951.

*4. The University of Kansas, Natural History Reservation. By Henry S. Fitch. Pp. 1-38, 4 plates, 3 figures in text. February 20, 1952.

5. Prairie Chickens of Kansas. By Maurice F. Baker. Pp. 1-68, 4 plates, 15 figures in text. March 10, 1953.

6. The Barren Ground Caribou of Keewatin. By Francis Harper. Pp. 1-163, 28 figures. October 21, 1955. Copies, paper bound, $1.50 postpaid from the Arctic Institute of North America, 1530 P Street NW, Washington 5, D. C.

7. Handbook of Mammals of Kansas. By E. Raymond Hall. Pp. 1-303, illustrated. December 13, 1955. Paper bound, $1.50 postpaid (cloth $4.00).

8. Mammals of Northern Alaska, on the Arctic Slope. By James W. Bee and E. Raymond Hall. Pp. 1-309, Frontispiece colored, 4 plates, 127 figures in text. March 10, 1956. Paper bound $1.00 postpaid.

9. Handbook of Amphibians and Reptiles of Kansas. 2nd [revised] edition. By Hobart M. Smith. Pp. 1-356, 253 figures in text. April 20, 1956. Paper bound $1.50 postpaid (cloth $4.00).

*10. The Raccoon in Kansas. By Howard J. Stains. Pp. 1-76, 4 plates, 14 figures in text. July 6, 1956.

11. The Tree Squirrels of Kansas. By Robert L. Packard. Pp. 1-67, 2 plates, 10 figures in text. August 20, 1956.

12. The Mammals of Keewatin. By Francis Harper. Pp. 1-94, 6 plates, 8 figures in text, 1 map. October 26, 1956. Copies, paper bound, 75 cents postpaid from the Arctic Institute of North America, 1530 P Street NW, Washington 5, D. C.

13. Museum of Natural History . . . University of Kansas. By Roy R. Moore and E. R. Hall. Pp. 1-8, illustrated. June 1, 1957.

14. Vernacular Names for North American Mammals North of Mexico. By E. Raymond Hall, Sydney Anderson, J. Knox Jones, Jr., and Robert L. Packard. Pp. 1-16. June 19, 1957.

15. The Ecology of Bobwhites in South-central Kansas. By Thane S. Robinson. Pp. 1-84, 2 plates, 11 figures in text. September 6, 1957.

16. Natural History of the Prairie Dog in Kansas. By Ronald E. Smith. Pp. 1-36, 4 plates, 9 figures in text. June 17, 1958.

17. Birds of the Ungava Peninsula. By Francis Harper. Pp. 1-171, 6 plates, 26 maps. October 15, 1958. Paper bound, $2.00 postpaid from the Arctic Institute of North America, 1530 P Street NW, Washington 5, D. C.

18. Furbearers in Kansas: A Guide to Trapping. By Howard J. Stains and Rollin H. Baker. Pp. 1-100, illustrated. November 19, 1958. Paper bound, 50 cents postpaid.

19. Museum of Natural History . . . University of Kansas. By Roy R. Moore and E. R. Hall. Pp. 1-8, illustrated. May 29, 1959.

20. Handbook of Gastropods in Kansas. By A. Byron Leonard. Pp. 1-224, 11 plates, 87 figures in text. November 2, 1959. Paper bound $1.00 (cloth $2.00).

21. Management of Channel Catfish in Kansas. By Jackson Davis. Pp. 1-56, 8 figures in text. November 2, 1959.

22. Hand-list of the Birds of Kansas. By Richard F. Johnston. Pp. 1-6. May 7, 1960.

23. Directory to the Bird-life of Kansas. By Richard F. Johnston. Pp. 1-69, 1 figure. August 31, 1960.

24. Guide to the Panorama of North American Mammals. By E. Raymond Hall *et al.* Pp. 1-32, illustrated. December 15, 1960. Paper bound, 50 cents postpaid.

25. Beaver in Kansas. By F. Robert Henderson. Pp. 1-85, illustrated. December 16, 1960.

* Out of print.

3 2044 093 361 574